Saskatchewan Environment and Resource Management

Saskatchewan's State of the Environment Report 2001

The Taiga Shield Ecozone: Land of the Caribou

Land of Little Sticks

"Tell me, Father, what is this white man's Heaven?"

"It is the most beautiful place in the world."

"Tell me, Father, is it like the land of the little trees when the ice has left the lakes? Are the great musk oxen there? Are the hills covered with flowers? There will I see the caribou everywhere I look? Are the lakes blue with the sky of summer? Is every net full of great, fat whitefish? Is there room for me in this land, like our land, the Barrens? Can I camp anywhere and not find that someone else has camped? Can I feel the wind and be like the wind? Father, if your Heaven is not all these, leave me alone in my land, the land of the little sticks."

– From the dialogue between a Dog-Rib Indian and a priest. Warburton Pike reported a slightly different version in his *The Barren Ground of Northern Canada.*

Source: P.G. Downes, N.D. Sleeping Island. R.H. Cockburn (Ed.), Western Producer Prairie Books.

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The Taiga Shield Ecozone: Land of the Caribou

Saskatchewan Environment and Resource Management

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Letter of Transmittal

April 2001

Dear Reader:

Our physical, social and economic well-being depends on a healthy environment. We all have a role to play in protecting the environment. State of the Environment reporting provides us with the information we need to make environmentally sensitive decisions.

This is the sixth State of the Environment report prepared in Saskatchewan. This report is the fourth in a series of four reports based on the province's new ecological land classification. This report focuses on providing information on current environmental trends, conditions and emerging issues in the Taiga Shield Ecozone.

I hope you find the information contained in this report interesting and useful. Any suggestions or opinions you may have to make these reports more useful are welcomed.

Yours sincerely,

Buckley Belanger

Acknowledgements

Saskatchewan Environment and Resource Management (SERM) extends its appreciation to the many persons who shared their knowledge, ideas and time in preparation of the 2001 State of the Environment report. A great deal of time and effort went into its preparation. To all of those who contributed, your assistance and dedication to the state of Saskatchewan's environment is much appreciated.

In particular, we are indebted to the State of the Environment Steering Committee, representing a variety of provincial and federal government departments who contributed to, edited, reviewed and assisted with the production of the document:

- Canadian Nuclear Safety Commission (formerly Atomic Energy Control Board [AECB])
- Department of Indian Affairs and Northern Development
- Environment Canada
- Saskatchewan Energy and Mines
- Saskatchewan Environment and Resource Management
- Saskatchewan Health
- Saskatchewan Highways and Transportation
- Saskatchewan Northern Affairs
- SaskPower
- SaskWater

We also thank Claude-Jean Harel at Great Excursions; Paul Dornstauder at CBC-Radio Canada; Bill Layman; Saskatchewan Municipal Affairs and Housing; and Calibre Consultants Inc. for their contributions. Special thanks go to Paul Geraghty for his illustrations that greatly enhance the report.

Many SERM staff contributed to this report, but special thanks go to the staff of SERM's Shield EcoRegion.

Preface

State of the Environment (SOE) reporting is intended to inform the people of Saskatchewan about the status of the province's environment and its resources. It helps us to understand how well we, as a society, are managing our environmental impacts and how we are progressing towards sustainable development or, in other words, how we are managing human activities to maintain ecological health and integrity.

The intent of this SOE report is to outline the specific impacts of human activity, judged deleterious to the future health of ecosystems of the Taiga Shield Ecozone. The report profiles the stresses imposed by natural processes and human activities and describes the present condition of the natural environment. The report also outlines a broad range of activities that are being conducted to mitigate for negative impacts on the environment.

This is the sixth SOE report prepared in Saskatchewan. This report is the fourth in which the information is organized on the basis of the ecological land classification system and focuses specifically on one ecozone – the Taiga Shield Ecozone.

Table of Contents

Letter of Transmittal i
Acknowledgements ii
Preface iii
Table of Contents v
List of Tables vii
List of Figures vii
List of Symbols, Measurements, Formulas And Acronyms viii
I. Introduction 1
II. Description of the Taiga Shield Ecozone 3
2.1 The Physical Environment 3
2.1.1 Context 3
2.1.2 Geology and Soils 3
2.1.3 Climate 7
2.1.4 Water Resources 8
2.2 The Biological Environment 8
2.2.1 Palaeontological Heritage 8
2.2.2 Flora 8
2.2.3 Fauna 12
2.3 The Cultural Environment 15
2.3.1 Human Heritage and Settlement 15
2.3.2 Demographics 16
2.3.3 Indian Reserves 17
2.3.3.1 Black Lake First Nation 17
2.3.3.2 Fond du Lac First Nation 17
2.3.3.3 Hatchet Lake First Nation 18
2.3.3.4 The Métis 18
2.3.4 Human Health and the Physical Environment 18

III. Stresses: Use of the Taiga Shield Ecozone 21
3.1 Land Use 21
3.1.1 Transportation 22
3.1.2 Protected Areas 23
3.1.3 Human Heritage 24
3.2 Water Use 24
3.2.1 Domestic and Commercial Water Use 25
3.2.2 Water Use for Hydroelectric Power 25
3.3 Non-renewable Resource Use 26
3.3.1 Mineral Exploration and Development 26
3.4 Renewable Resource Use 30
3.4.1 Forests 30
3.4.1.1 Forestry Development 30
3.4.1.2 Forest Fires, Insect Damage and Disease 30
3.4.2 Climate Change 30
3.4.3 Fish and Wildlife 32
3.4.3.1 Sport Fishing and Hunting 32
3.4.3.2 Outfitting 33
3.4.3.3 Commercial Trapping 33
3.4.3.4 Subsistence Hunting/Fishing/Trapping/Gathering 33
3.4.3.5 Enforcement and Compliance 33
3.4.4 Ecotourism and Recreation 34
3.5 Economic Significance of Resource Use 35
3.5.1 Non-renewable Resources 35
3.5.2 Forest Fire Suppression 36
3.5.3 Commercial Use of Renewable Resources 36
3.5.3.1 Forestry 36
3.5.3.2 Commercial Fishing 36
3.5.3.3 Commercial Trapping 38
3.5.3.4 Outfitting 38
3.5.4 Recreation-related Activities 38
3.5.4.1 Ecotourism 40
3.5.4.2 Sport Fishing 40
3.5.4.3 Sport Hunting 40
3.5.5 Subsistence Hunting/Fishing/Trapping/Gathering 41
3.6 Northern Settlements 42
3.6.1 The Northern Hamlet of Stony Rapids 42
3.6.2 The Northern Settlement of Wollaston Lake 42
3.6.3 The Northern Settlement of Uranium City 43
3.6.4 The Northern Settlement of Camsell Portage 43

IV. Condition: Status of the Taiga Shield Ecozone 45
4.1 Land 45
4.1.1 Heritage Sites 45
4.2 Air 45
4.2.1 Human Health Impacts of Air Quality 45
4.2.2 Acid Precipitation 45
4.2.3 Particulates 45
4.3 Water 45
4.3.1 Surface Water Quality 46
4.3.2 Surface Water Quantity 46
4.3.3 Transboundary Water Management 47
4.3.4 Domestic and Community Water Supplies 47
4.3.5 Effects of Hydroelectric Developments 48
4.4 Wastes and Hazardous Material 48
4.4.1 Mining Waste Creation and Disposal Practices 48
4.4.2 Spills of Hazardous Substances 48
4.4.3 Contaminated Sites 49
4.4.4 Domestic Sewage Disposal 49
4.4.5 Exploration Camps 49
4.4.6 Mine Openings 49
4.5 Renewable Resources 50
4.5.1 Forestry 50
4.5.2 Forest Fire, Disease and Insect Damage 50
4.5.3 Wildlife Populations 50

4.5.4 Subsistence Hunting/Fishing/Trapping/ Gathering....51
4.5.5 Fish and Other Aquatic Life....52
4.5.6 Rare and Endangered Species....53
4.6 Culture and Heritage....54

V. Response: Management Initiatives Affecting the Taiga Shield Ecozone....55
5.1 Ecosystem Management....55
5.2 Mining Initiatives....55
5.2.1 Joint Review Group for Mining Activity....55
5.2.2 Mine Decommissioning and Reclamation....55
5.2.3 Environmental Quality Committees....56
5.2.4 Northen Mines Monitoring Secretariat....57
5.2.5 Uranium Mining Contingency Reserve....57
5.2.6 Cumulative Effects Monitoring of Uranium Mining....57
5.3 Acid Precipitation....58
5.4 Water Management Initiatives....58
5.4.1 Saskatchewan Water Management Framework..58
5.4.2 Hydroelectric Reservoir and Flow Management....59
5.4.3 Municipal Water and Sewer Infrastructure....60
5.5 Pollution Prevention and Waste Management....60
5.5.1 Spill Control....60
5.5.2 Domestic Sewage and Landfill Initiatives....60
5.6 Environmental Assessment....60
5.6.1 Environmental Assessment Legislation....60
5.7 Renewable Resource Management Activities....61
5.7.1 Crown Land Management Steering Committee..61
5.7.2 Integrated Land Use Plans....61
5.7.3 Enforcement and Compliance Framework....61
5.7.4 Provincial Representative Areas Network....63
5.7.5 Fire and Forest Insect and Disease Management....64
5.8 Environmental Monitoring....64
5.9 Culture and Heritage Initiatives....67
5.9.1 Aboriginal Policy....67
5.9.2 Northern Strategy....68
5.9.3 Heritage Property Protection....68
5.10 Public Involvement....68
5.10.1 Consultation....69
5.10.2 Partnerships....69
5.10.3 Co-management....69

VI. Summary....71

Appendix 1
Landscape Areas within the Taiga Shield Ecozone....75
Appendix 2
Forest Communities in the Taiga Shield Ecozone....79
Appendix 3
Provincial and COSEWIC Rank Definitions....85
Appendix 4
Flora (Vascular Plants) of the Taiga Shield Ecozone....87
Appendix 5
Fauna of the Taiga Shield Ecozone....111
Appendix 6
Climate Change Initiatives....116
Appendix 7
Status of Saskatchewan Furbearers....117
Appendix 8
Species-at-Risk Legislation....119
Appendix 9
List of Abandoned Underground Exploration/Mining Sites in the Taiga Shield Ecozone....120
Appendix 10
Saskatchewan's Representative Areas Network....125
Glossary....127
Reference and Reading List....131

List of Tables

		Page
Table 1	1999 Population Levels, First Nation and Northern Municipal Communities, Athabasca Basin, Saskatchewan	17
Table 2	First Nations and Indian Reserves in the Taiga Shield Ecozone	18
Table 3	Number of Hectares Burned in the Taiga Shield Ecozone in Last 11 Years	30
Table 4	Grassroots Mineral Exploration Expenditures in Saskatchewan	36
Table 5	1996-97 Commercial Fish Harvest in the Taiga Shield Ecozone	36
Table 6	Comparison of Annual Pelt Production and Pelt Value, 1994/95-1998/99	38
Table 7	Selected Saskatchewan Surface Water Quality Objectives for the Protection of Aquatic Life and Wildlife	46
Table 8	Commercial Marketing of Furbearer Pelts in the Taiga Shield Ecozone, 1994/95 through 1998/99, Inclusive	52
Table 9	Canadian Species-at-Risk in the Taiga Shield Ecozone	53
Table 10	Taiga Shield Water Quality	65
Table 11	Taiga Shield Sediment Quality	66
Table A1	Soils Associated with Upland Conditions in the Selwyn Lake Upland Ecoregion	79
Table A2	Soils Associated with Lowland Conditions in the Selwyn Lake Upland Ecoregion	79
Table A3	Spruce and Hardwood Communities in the Selwyn Lake Upland Ecoregion	80
Table A4	Height, Diameter and Age of Trees on the Site Types in the Selwyn Lake Upland Ecoregion	81
Table A5	Soils Associated with Upland Conditions in the Tazin Lake Upland Ecoregion	81
Table A6	Soils Associated with Lowland Conditions in the Tazin Lake Upland Ecoregion	81
Table A7	Vegetative Communities in the Tazin Lake Upland Ecoregion	82
Table A8	Height, Diameter and Age of Trees on Site Types in the Tazin Lake Upland Ecoregion	84

List of Figures

		Page
Figure 1	Terrestrial Ecozones of Canada	4
Figure 2	Ecozones of Saskatchewan	4
Figure 3	The Taiga Shield Ecozone – Reference Map	5
Figure 4	The Taiga Shield Ecozone Drainage Basins	9
Figure 5	Indian Reserves in the Taiga Shield Ecozone	19
Figure 6	Electrical Transmission Lines Servicing the Taiga Shield Ecozone	26
Figure 7	Hydroelectric Stations Located in the Taiga Shield Ecozone	27
Figure 8	Reference Map of Historic Mining Activity in the Taiga Shield Ecozone	29
Figure 9	Forest Fire History of Northern Saskatchewan 1945-1999: Fires Greater than 1,000 ha	31
Figure 10	Waterbodies with Fish Outfitting Operations in the Taiga Shield Ecozone	34
Figure 11	Fire Management Personnel Field Locations for the Taiga Shield Ecozone	37
Figure 12	Annual Pelt Value for Saskatchewan, 1970/71-1998/99	39
Figure 13	Annual Pelt Production and Number of Trappers in Saskatchewan, 1970/71-1998/99	39
Figure 14	Range Map of the Beverly and Qamanirjuaq Barren-ground Caribou	51
Figure 15	Planning Areas and Stages of the Northern Saskatchewan – Lake Athabasca Region Agreement	62

List of Symbols, Measurements, Formulas and Acronyms

Symbols/Measurements

C	=	Celsius
dam^3	=	1,000 m^3
g	=	gram
ha	=	hectare
kg	=	kilograms
kg/ha	=	kilograms per hectare
km	=	kilometre
kWh	=	kilowatt hours
m	=	metre
mm	=	millimetres
mg/h	=	milligrams per hour
mg/L	=	milligrams per litre
m^3/s	=	cubic metre per second
MW	=	megawatt
pH	=	water acidity measurement
t	=	tonnes
µ	=	micron
µg/g	=	micron grams per gram
µS	=	micro siemens (inverse Ohm)

Elements

Al	=	aluminum
C	=	carbon
Ca	=	calcium
Fe	=	iron
K	=	potassium
Mg	=	magnesium
N	=	nitrogen
Na	=	sodium
O	=	oxygen
Pb	=	lead
Po	=	polonium
Ra	=	radium
S	=	sulphur
Si	=	silicon
T	=	titanium
Th	=	thorium
U	=	uranium

Formulas

$CaCO_3$	=	calcium carbonate
NO_x	=	oxides of nitrogen
SO_2	=	sulphur dioxide

Acronyms

AECB	Atomic Energy Control Board
ARCAL	airport radio-controlled runway lighting systems
ATV	all terrain vehicle
BQCMB	Beverly-Qamanirjuaq Caribou Management Board
CEAA	*Canadian Environmental Assessment Act*
CEC	cation exchange capacity
CEM	Cumulative Effects Monitoring
CITES	Convention on International Trade and Endangered Species
CNSC	Canadian Nuclear Safety Commission
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Department of Fisheries and Oceans (Canada)
DIAND	Department of Indian Affairs and Northern Development
DU	Ducks Unlimited
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
ELC	ecological land classification
ESS	Ecotourism Society of Saskatchewan
EQC	Environmental Quality Committee
FSIN	Federation of Saskatchewan Indian Nations
GG	greenhouse gases
IBP	International Biological Program
ILUPs	integrated land use plans
JRG	Joint Review Group
MNS	Métis Nation of Saskatchewan
MOU	memorandum of understanding
NAD	Northern Administration District
NWT	Northwest Territories
NFCA	Northern Fur Conservation Area
NFCB	Northern Fur Conservation Block
NMMS	Northern Mines Monitoring Secretariat
PCB	polychlorinated biphenyls
PFRA	Prairie Farm Rehabilitation Administration
RAN	Representative Areas Network
RCMP	Royal Canadian Mounted Police
SEM	Saskatchewan Energy and Mines
SERM	Saskatchewan Environment and Resource Management
SOE	State of the Environment
VECs	Valued Ecosystem Components
WHO	World Health Organization
WMZ	Wildlife Management Zone

1 Introduction

People are changing their attitudes and behavior as they realize that the health of the environment is a responsibility shared by all. Historically, there was little concern for the environment, and the results of this abuse are still evident. There are opportunities to do better in the future by working to understand the results of stresses to the environment, developing standard measures or indicators to track these stresses and developing effective programs to mitigate impacts to assure a sustainable future. State of the Environment (SOE) reporting is one way of gaining a better understanding about Saskatchewan's environment and our society's influence on sustaining a healthy environment.

SOE reporting builds on a number of other initiatives. In June of 1992, the Saskatchewan Round Table on Environment and Economy completed its *Conservation Strategy for Sustainable Development in Saskatchewan*. The conservation strategy promoted sound environmental, social and economical use and protection of Saskatchewan's resources. The strategy was built on the concept of sustainable development and is the major foundation piece for achieving a sustainable society. In October 1994, Saskatchewan released its *Saskatchewan's Environmental Agenda: Securing a Sustainable Future*, which focused on the government's role in achieving a sustainable society. It re-affirmed the vision and principles of the conservation strategy by outlining specific actions. The agenda also re-affirmed the importance of preparing a regular SOE report, as legislated in *The State of the Environment Report Act*, 1990. The Act requires that Saskatchewan prepare a report every two years, as a monitoring mechanism for the state of the environment.

The objectives of SOE reporting are:

- to raise public understanding and education about environmental issues;
- to assist with understanding the relationship between human activities and environmental quality, and the sustainability of ecosystems; and
- to provide a broad basis for improved decision-making on environmental matters.

SOE reporting is not unique to Saskatchewan. Other provinces, as well as the federal government, are involved in this type of reporting. SOE reports vary in scope, style, content and approach. Some jurisdictions complete broad, comprehensive reports on various environmental issues, while others focus on a single issue. Some reports provide extensive descriptive information about the environment, while others focus on certain measures or indicators of environmental condition, related to public concerns or issues.

The first Saskatchewan SOE report (*Saskatchewan State of the Environment Report, 1991*) identified general environmental trends and potential issues or problems affecting renewable and non-renewable resources in the province.

The second SOE report (*Saskatchewan's State of the Environment Report: The Need for Environmental Indicators, 1992*) focused on the use of environmental indicators and a reporting framework based on ecological units within the province.

The third SOE report (*Saskatchewan's State of the Environment Report, 1995 – The Boreal Plain Ecozone: A Forest Community*) refined and standardized an ecosystem approach to SOE reporting based on one of Saskatchewan's four major natural landscapes, or ecozones. These ecozones are described in detail in this 1995 report, as they are part of a new ecological land classification system for Saskatchewan. The classification system provides a framework for discussing environmental conditions within the context of the natural systems.

The 1995 report also introduced the stress-condition-response approach, which organizes environmental information according to stresses on the environment, conditions resulting from these stresses and responses to these conditions by both humans and the environment. Environmental indicators are often used in this approach. Saskatchewan Environment and Resource Management (SERM) is developing a monitoring strategy and a set of indicators, but extensive work is still needed to implement a monitoring program that uses indicators for environmental reporting. Therefore, Saskatchewan's SOE reports currently focus on descriptive information.

The fourth SOE report (*Saskatchewan's State of the Environment Report 1997 – The Prairie Ecozone: Our Agricultural Heartland)* and the fifth report (*Saskatchewan's State of the Environment Report 1999 – The Boreal Shield Ecozone: A Land of Lakes and Forests*) added a sector focus to the report. A sector approach focuses on a specific issue (e.g., mining, agriculture, industry, forestry) or sector of the environment, such as water quality or wildlife.

Saskatchewan's State of the Environment Report 2001 – The Taiga Shield Ecozone: Land of the Caribou focuses on the Taiga Shield Ecozone. It also follows an ecosystem-based, stress-condition-response approach, with some focus on the sector of historical mining development. This ecozone is in the extreme northern part of Saskatchewan, adjacent to the Northwest Territories (NWT). The natural flora and fauna are much reduced in numbers and diversity compared to the rest of the province, as the soils are poor and the climate is severe.

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ECOLOGICAL LAND CLASSIFICATION SYSTEM

Ecological land classification (ELC) is a method of ordering or arranging different types of landscapes into groups based on their similarities and differences. It involves classifying ecologically distinctive areas of the Earth's surface based on various factors, including geology, landform, soils, vegetation, climate, wildlife, water and human activity. The purpose of such a system is to provide a conceptual framework for management of the environment.

The ELC System of Canada is the product of two years of research and consultation with federal, provincial and territorial agencies. The system divides Canada's natural landscapes into 15 terrestrial ecozones, which are in turn subdivided into over 180 ecoregions and more than 5,000 ecodistricts.

Ecozones are the most generalized level in the classification system, with distinctive combinations of physical and biological characteristics. These characteristics are generalized and tend to endure over the long term. Ecoregions and ecodistricts (landscape areas) represent subdivisions at progressively more detailed levels of ecological characteristics. Ecodistricts are directly linked to the more than 17,000 soil landscape units of the Soil Landscapes of Canada Map Series produced by Agriculture and Agri-Food Canada.

Four of the 15 ecozones in Canada occur in Saskatchewan: the Taiga Shield, Boreal Shield, Boreal Plain and Prairie.

Raven

II Description of the Taiga Shield Ecozone

2.1 The Physical Environment

2.1.1 Context

The Taiga Shield Ecozone is part of the general tundra and boreal forest transition that extends from Labrador to Alaska. More specifically, it is a vast, broadly rolling plain that lies on either side of Hudson Bay. The western part of this plain extends from Hudson Bay to the Mackenzie Valley, between the Boreal Shield and the Southern Arctic ecozones. Figure 1 illustrates Canada's 15 terrestrial ecozones.

In Saskatchewan, the Taiga Shield Ecozone extends from Lake Athabasca at the Alberta border north to the NWT, and east to Zangeza Bay in northern Reindeer Lake, at the Manitoba border (Figures 2 and 3). It is the smallest ecozone in Saskatchewan, occupying only 4.7 million hectares or approximately 7% of the provincial land mass. This ecozone is only accessible by winter road, water and air, and as such, much of this land remains in a wilderness condition.

A lichen woodland typifies the vegetation that occurs in this subarctic climate. The climate is subhumid, characterized by cold temperatures and low precipitation.

The Tazin Lake and Selwyn Lake Upland ecoregions comprise the Taiga Shield Ecozone (Figure 3). Each ecoregion reflects variations in landscape within the ecozone. For ecological land classification purposes (see sidebar), each ecoregion can also be further subdivided into "landscape areas," or areas of relatively homogeneous physical landscape and climate conditions. Landscape areas differ based on landforms, vegetative land cover, soil texture and development. The eight landscape areas of the Taiga Shield Ecozone are listed and described in detail in Appendix 1. Forest communities in the ecozone, based on surveys conducted by SERM, are described in Appendix 2. A general description of the ecozone is provided in the following sections.

2.1.2 Geology and Soils

The **Taiga Shield Ecozone** is underlain by part of the Canadian Shield, a geological terrain of Precambrian rocks. In northern Saskatchewan, the Canadian Shield comprises several distinct geological domains, such as the Mudjatik, Wollaston, Dodge and Train Lake domains. The ecozone, which includes the Selwyn Lake Upland Ecoregion and the Tazin Lake Upland Ecoregion, has been glacially sculptured and overlain by variable amounts of Quaternary glacial deposits. Rocks in the ecozone range in age from 1.2 to 3.4 billion years.

The Taiga Shield Ecozone is dominated by Precambrian bedrock outcrops and discontinuous glaciofluvial and morainal deposits. The Precambrian basement rocks, remnants of former mountains that have been eroded to a peneplain, are reflected in a series of broad, smooth uplands and intervening lowlands, with very irregular local relief. Elevations on this peneplain range from 350 to nearly 600 m.

Brunisolic soils prevail in well-drained positions in the landscape, with gleysolic soils in some poorly drained areas. Peat occurs in numerous bogs and fens. For the most part, these are not frozen permanently and are classified as organic soils. They are often frozen under black spruce, however, where they are classified as cryosolics. There is virtually no soil development on the numerous exposures of crystalline basement rocks.

Many of the lakes and intervening bedrock ridges are elongated along a northeast-southwest axis. This results in a

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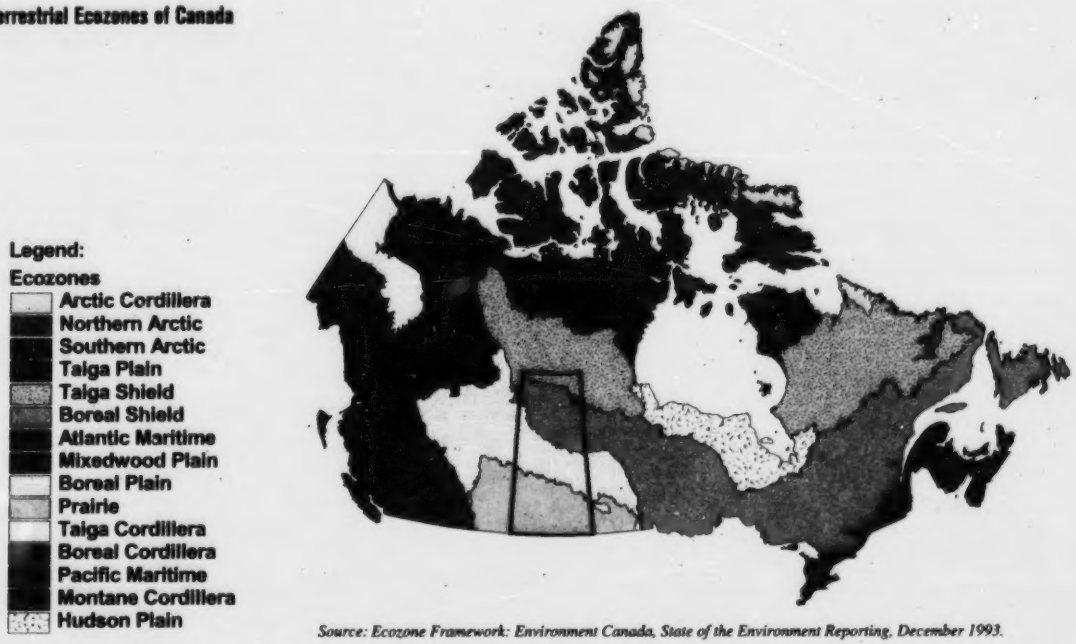
Figure 1 Terrestrial Ecozones of Canada



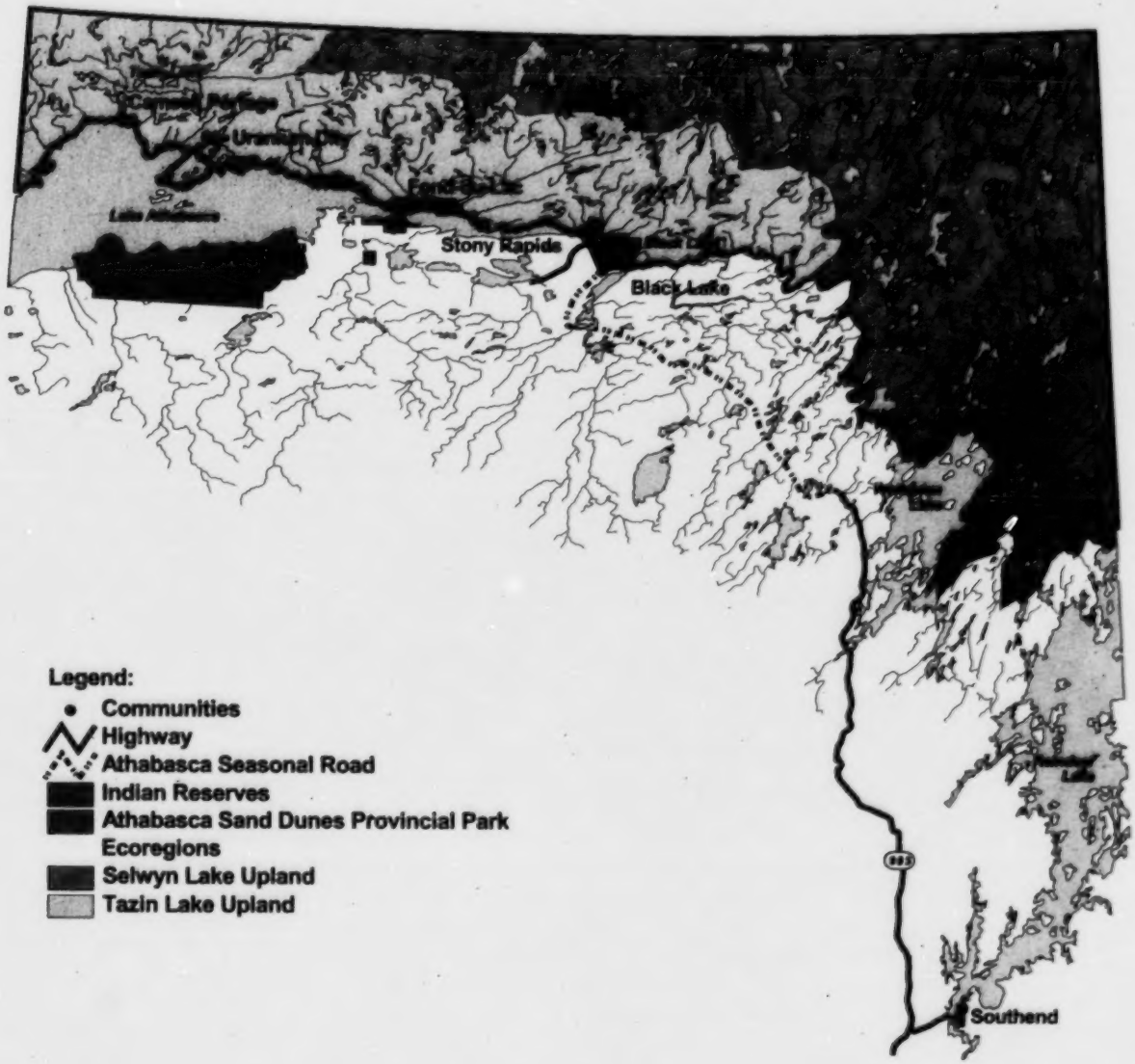
Source: Ecozone Framework: Environment Canada, State of the Environment Reporting, December 1993.

Figure 2 Ecozones of Saskatchewan

	Ecozone	Ecoregion	Landscape Area
	Taiga Shield	Selwyn Lake Upland	A1 - A8
		Tazin Lake Upland	B1 - B2
	Boreal Shield	Athabasca Plain	C1 - C12
		Churchill River Upland	D1 - D11
	Boreal Plain	Mid-Boreal Upland	E1 - E30
		Mid-Boreal Lowland	F1 - F4
		Boreal Transition	G1 - G23
	Prairie	Aspen Parkland	H1 - H22
		Moist Mixed Grassland	K1 - K20
		Mixed Grassland	M1 - M25
		Cypress Upland	N1 - N2

Source: Padbury and Acton, 1994.

Figure 3 The Taiga Shield Ecozone – Reference Map



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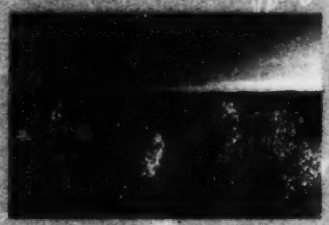
"Once, very long ago, just after the Great Spirit had created everything, filled the woods with game and the waters with fish, lived a huge beaver. It was bigger than the biggest buffalo, its tail was like an outspread moose hide, and when it hit the water it was like thunder. The beaver lived in the west end of Lake Athabasca, where it dammed up the water at the spot where Fitzgerald now stands and created the falls there. The water backed up and enlarged the lake, flooded the whole country and created the marshes around the mouth of the river. The beaver also cut down all the timber, and still today you find nothing but willows and alder growing in the delta and bare sand-plains along the south shore.



Beaverlodge Lake in the fall.
Ross Barclay

The humans got angry at the beaver for spoiling their grounds, and one mighty hunter swore to capture and kill it. But before he had time to do so the beaver escaped to Beaverlodge Lake. There it built itself a new lodge, so big and strong that nobody could break it down – you can still see it, it's Beaverlodge Mountain – and dammed up the lake at the portage. You can still see by the shape of the sand-ridge there that it had once been a beaver dam.

But the hunter did not give up. He soon found the beaver's hideout and one day he surprised it out on

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trellis-like drainage network, with many rivers flowing parallel to one another in a northeast-southwest direction. Connecting these are short streams, generally at right angles to the major rivers, which follow faults, regional joint sets, or other weaknesses in the bedrock.

The **Tazin Lake Upland Ecoregion**, the large area lying to the north of Lake Athabasca, the Fond du Lac River and Black Lake, is an area with broad rugged slopes of crystalline basement rocks that are sparsely covered with glacial drift.

Most of this ecoregion is characterized by a rugged terrain of rocky ridges and valleys, with local topographic relief approaching 100 m or more. Elevations range from less than 300 m on the large lakes along the southern margin to approximately 500 m in the northern part of the area.

The ecoregion is underlain by several geological domains, varying in geological history and rock type, that effect present day topography and human activity. Different types of Archean Era gneisses and younger granitoid intrusions and sedimentary rocks underlie much of the area. The domains are typically separated by zones of intense deformation that produced faults that can be seen from the air and on satellite images.

Bedrock outcrops dominate the rises, and brunisolic soils are scattered throughout the intervening intermediate slopes, where they are associated with sandy and, frequently, stony glacial deposits. Organic soils prevail in fens, with cryosolics occurring in occasional bogs that are permanently frozen.

The Tazin Lake Upland Ecoregion primarily drains southward to Lake Athabasca and from there to the Athabasca, Slave and Mackenzie rivers. The Tazin Lake area drains northward through the Tazin River to the Taltson River, which empties into Great Slave Lake, and from there through the Slave and Mackenzie rivers to the Beaufort Sea. Part of Tazin Lake is now diverted so that it eventually flows into Lake Athabasca.

The **Selwyn Lake Upland Ecoregion** is ridged to hummocky where crystalline bedrock forms broad, gently sloping terrain. Local relief rarely exceeds 50 m and elevations are typically in the order of 350 to 420 m, reflecting a more subdued relief than in the Tazin Lake Upland.

The ecoregion is primarily underlain by granitoid rocks of the Mudjatik and Wollaston domains in the northeastern corner of Saskatchewan. The granitoid rocks form 2.7 billion year old Archean Era basement rocks, to younger, mainly sedimentary, rocks. More extensive sedimentary rocks in the Wollaston Domain are thought to represent a prograding wedge of shallow-water sediment at a continental margin. These rocks extend southwest into the Boreal Shield Ecozone where they are instrumental in determining the location of major uranium deposits. Relief in the eastern part of the ecoregion is generally low with few bedrock exposures and large expanses where the bedrock has weathered

Beaver

to form fields of large angular blocks. Bedrock exposure is more common in the northwestern extension of the Selwyn Lake Ecoregion, where it is underlain by the Dodge and Train Lake domains. This part of the ecoregion comprises mostly granitoid rocks that were partially melted during the Archean Era in the Train Lake Domain, and similar rocks, but with a larger volcanic and sedimentary rock component, in the Dodge Domain.

In the Selwyn Lake Upland Ecoregion the Precambrian rocks form broad sloping uplands dominated by sandy ridges traveling in a northeast-southwest direction. Bedrock outcrops dominate the rises, and brunisols are scattered throughout the intervening intermediate slopes, where they are associated with sandy and, frequently, stony glacial deposits, prominent, sinuous esker ridges and cigar-shaped drumlins. The ground moraine is thicker and more continuous in this ecoregion than in the Tazin Lake Upland Ecoregion. Morainal or till plains and drumlinoid moraines are the dominant morphologies.

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2.1.3 Climate

The Taiga Shield Ecozone is transitional from the subarctic climate to the south and the arctic climate to the north. The climate is characterized by long, very cold winters, which last 7-8 months. The short, cool summers have periods of daylight greater than 18 hours per day, offsetting, to some degree, the shorter growing season and the less intensive solar radiation, compared to other ecozones in the south. Temperatures tend to decrease slightly from west to east across the ecozone, due mainly to a stronger continental effect in the eastern part of the area. Total precipitation is variable and low, and tends to decrease toward the northern boundary of Saskatchewan. Maximum precipitation occurs from July through September.

In the Tazin Lake Upland Ecoregion the mean annual daily temperature is 3.5°C. The mean July temperature is 16.2°C, and the mean January temperature is -26.8°C. The mean annual precipitation is 362 mm, with 197 mm of rainfall occurring from May to September. The summers are

Beaverlodge Mountain (continued)

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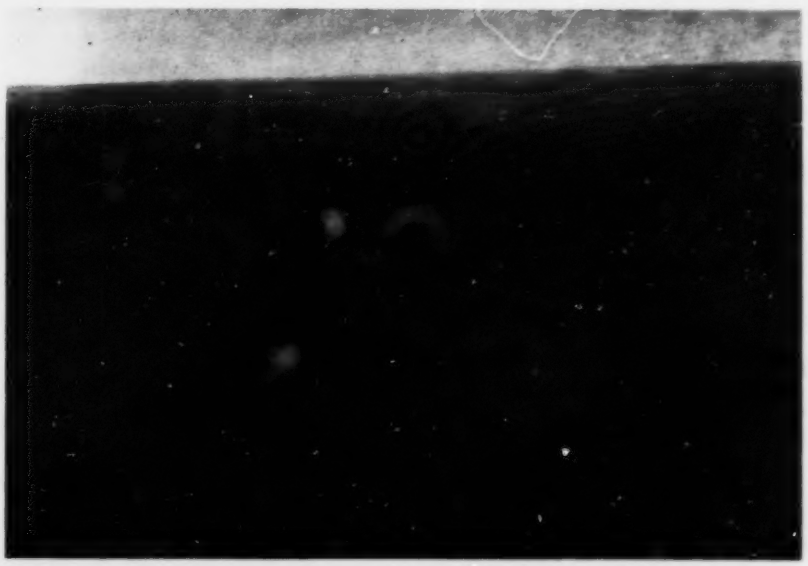

A large esker south of Hasbala Lake in the Selwyn Lake Upland Ecoregion. Eskers are surface geological features laid down during the melting and retreat of the continental ice sheet about 8,000 years ago. Rivers flowed across the ice sheets and deposited sands in their icy stream beds. When the ice melted away, the sands were deposited on the ground, leaving a record of where glacial rivers once flowed. Robert A. Wright

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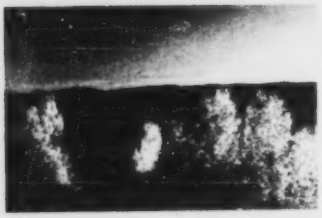

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short and cool, with a frost-free period of 105 days.

Lake Athabasca has a moderating effect on the climate in its vicinity, maintaining a higher than normal evening temperature during its unfrozen periods, so that the frost-free period on surrounding lands is extended.

In the Selwyn Lake Upland Ecoregion, the mean annual daily temperature is - 4.9°C. The mean July temperature is 15.7°C, and the mean January temperature is -28.5°C. The mean annual precipitation is 369 mm, with more than 241 mm of rainfall occurring from May to September. The summers are short and cool, having a frost-free period of 96 days.

2.1.4 Water Resources

The Taiga Shield Ecozone straddles the continental divide between the Beaufort Sea and Hudson Bay. About 30% of the region is covered by water. About 70% of the area drains into the MacKenzie River via the Tazin River and Lake Athabasca drainage basins. The remainder flows to the Churchill and Nelson rivers via the Cochrane River and Kasba Lake watersheds, respectively. Two of Saskatchewan's largest lakes, Athabasca and Wollaston, are situated along the border with the Boreal Shield Ecozone. Figure 4 shows the drainage basins in the Taiga Shield Ecozone.

The streams and lakes in the Taiga Shield Ecozone derive their water from spring runoff originating in the interior of the ecozone. The ecozone's rugged terrain produces a generous supply of surface water that is 4 to 20 times greater than that produced in southern Saskatchewan. Rivers in the region generally rise from April to July during snow melt and recede to a more or less constant value from January to March. Peak flows tend to be less than in rivers fed from the mountains.

Ninety percent of Wollaston Lake's outflow enters the Cochrane River, which flows into Reindeer Lake and the Churchill River system. The Cochrane River is the area's second largest river, with a mean annual flow of 166 m^3/s.

The Fond du Lac River, the ecozone's largest river, originates at Wollaston Lake and conveys about 10% of that lake's outflow. The river dramatically increases in size as it leaves Black Lake, with a mean annual flow of about 300 m^3/s. The Chipman, Porcupine and Cree rivers have mean annual flows of 12, 68 and 121 m^3/s, respectively, and drain into Black Lake. Lake Athabasca receives about 10% of its water from the Fond du Lac River.

The Peace and Athabasca rivers contribute about four-fifths of the inflow to Lake Athabasca. Hence, they play a significant role in determining the lake's water level and water quality. Lake Athabasca drains through Riviére des Rochers to the Slave River and, ultimately, to the Mackenzie River.

The supply of groundwater in the Taiga Shield Ecozone varies greatly and is essentially limited to surficial aquifers. The shallowness of the glacial drift minimizes the opportunity for inter-till aquifers. Faults and fractures in the bedrock also contain water, but this supply is extremely limited. Bogs are likely to have permafrost, thus limiting their usefulness as a groundwater source.

Permafrost, defined as frozen ground that, at a minimum, remains frozen from one winter to the next, occurs sporadically across the ecozone. It is discontinuous and limited to areas where peat, moss and other vegetation provide an insulating cover to the soil.

Tazin River, George Bihun

2.2 The Biological Environment

2.2.1 Palaeontological Heritage

Due to the predominance of ancient Precambrian rock on the ground surface, which preceded any human habitation, the palaeontological resources of the Taiga Shield Ecozone are considered to be minimal to non-existent.

2.2.2 Flora

The **Taiga Shield Ecozone** is an area of transition in which the coniferous forest passes into a zone of subarctic woodland. The northeastern area forest vegetation is dominated by black spruce (*Picea mariana*), lichen and feathermoss woods. Lowland areas are composed of bogs, which may be wooded or treeless, and fens. The area around Uranium City tends to

be slightly warmer, a transition area that reflects a high boreal climate. Here closed-crown coniferous forest occurs on upland areas and treed bogs cover the lowlands.

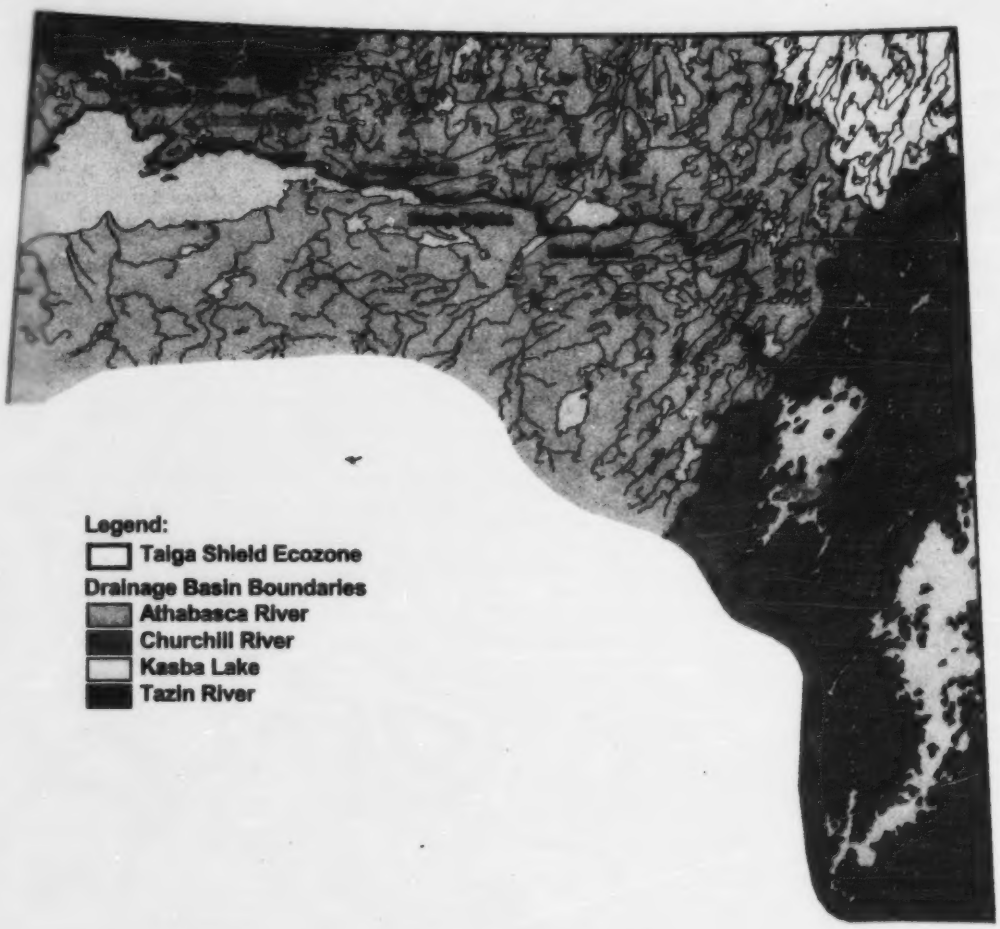
The vegetation of the **Tazin Lake Upland Ecoregion** is distinguished from that of the Selwyn Lake Upland Ecoregion by the prevalence of closed-crown black spruce-jack pine forests, with shady forest floors occurring on both upland and lowland areas. The high boreal climate is less harsh than the subarctic climate in the Selwyn Lake Ecoregion; therefore, the trees tend to be larger and the area more productive. Black spruce-jack pine forest, rock lichen, lichen woodland, peatlands (peat plateaus and sedge fens) and boreal wetlands are the major plant associations that occur in this ecoregion.

In the black spruce-jack pine forest, jack pine with lichen ground cover is the prevalent vegetation on warm and dry sites; in the absence of fire, the trend is toward black spruce on the moist and cool sites. White spruce and balsam fir prefer moist sites associated with river valleys or lake shorelines. Stands of trembling aspen or white birch are also present, occasionally. Where the till veneer is deep enough for adequate rooting, the canopy is underlain by a shrub layer of narrow-leaved and common Labrador tea and small bog-cranberry, with a mossy ground cover.

A shrub-heath woodland is found on very shallow glacial till veneers and on south-facing esker slopes, where bare ground accounts for up to one-third of the surface. Stunted black spruce, jack pine and white birch are found scattered among various shrubs. Lichens, mosses and herbs are not abundant, and purple reed grass is the only significant grass.

This ecoregion has an approximate fire cycle of one fire every 100 years, which can be expected in a landscape where there is fuel continuity (closed-crown forest) on surface materials that are subject to rapid drying (thin glacial drift over bedrock); however, the rough topography does make local burning difficult in some areas. Jack pine is particularly suited to survival on these sites with coarse drift and in fissures of rock outcrops, due to its low moisture requirements. This, in combination with its early production of serotinous cones, displays its adaptation to fire-driven

Figure 4 The Taiga Shield Ecozone Drainage Basins



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LICHENS

Lichens have the ability to survive under stressful conditions such as extreme cold and drought. In the Taiga Shield Ecozone they can grow where few other plants can, such as on rock surfaces and on the trunk and branches of trees. They are well suited to subarctic and arctic environments because they can grow in low temperature and light and are not damaged easily by frost. When environmental conditions are not optimal for growth, they become dormant until more favourable conditions return.

Lichens are a unique combination of algae and fungi. In this symbiotic relationship, the fungus provides a substratum or structure on which the algae live. The algae photosynthesize, creating the energy compounds that feed both the algae and the fungal partner. There are many forms of lichens: tiny crustose lichens that grow principally on rock, larger foliose lichens that grow on soils or trees and fruticose lichens, such as reindeer lichen (Cladina sp.) that resemble miniature trees or shrubs and usually grow on soils or rotting wood. Differences in the chemical make-up of the fungal partner are responsible for the colour differences among lichen species. At least 137 species of lichens are known to exist in the Taiga Shield Ecozone; one-half of the species are fruticose, while crustose and foliose lichens each comprise about one-quarter of the species found.

Reindeer lichens, often called reindeer moss, of the genus Cladina, are the most important winter food for caribou and musk oxen. These lichens commonly form extensive carpets over the ground in open

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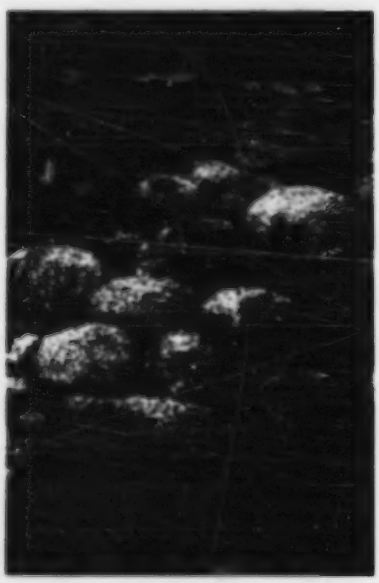
ecosystems. While medium to tall, closed stands of trembling aspen, white birch and balsam poplar are common after a fire, they are a minor component of the forest. White spruce, balsam fir and black spruce occur in late successional stages.

The peatlands are dominated by sedge fen, which are composed of sedges, cotton-grasses, horsetails and bulrushes. Shrubs, with willows, green alder and dwarf birch predominating, are found around the margins of the fens.

The peat plateaus are wooded, covered with low open stands of black spruce, or mixed stands of black spruce and tamarack. Peat, or sphagnum moss, is the main groundcover, interspersed with common and narrow-leaved Labrador tea, bog cranberry and cloudberry. In areas that are very poorly-drained, sedge-dominated fens are associated with tamarack. The permafrost is less extensive than in the Selwyn Lake Upland Ecoregion, and no polygonally patterned peat plateaus exist. However, the peatlands do display thermokarst features such as melt-out pools, which are less acidic than the peat plateau itself. The vegetation associated with these includes various sedges and bulrushes, dwarf birch and tamarack.



Cushion-like colonies of lichen (Stereocaulon sp. and Cladina mitis) grow on sandy soil in a jack pine forest. Robert A. Wright

The rock lichen woodland occurs on very shallow till veneers, where droughty conditions are common. A very open stand of stunted jack pine grows in local pockets of glacial drift and in bedrock fissures, while the surrounding bare rock is covered with rock lichens. Along bedrock fractures, where soil is deeper, there is increased diversity of shrubs, lichens and mosses.

The vegetation of the **Selwyn Lake Upland Ecoregion** is fairly uniform and simple compared to that of other ecoregions, because of the subarctic climate. Lichen woodland, rock lichen, peatlands (peat plateaus, palsas and sedge fens) and boreal wetlands are the major vegetation associations.

Open lichen woodland is characterized by stunted black spruce scattered in an open, park-like setting, with a ground cover of yellowish to whitish colored lichens, interspersed with dwarf shrubs. On wetter slopes, the trees are much closer together, and vascular plants and mosses become a significant component in the groundcover. The trees in this ecoregion are small for their age, a result of the harsh climate and short growing season.

The black spruce is the climax species in the ecoregion and is the most prevalent tree. Jack pine, the second most common tree, dominates where the glacial drift veneer is thin, and on sandy and gravelly outwash plains where conditions are drier. White spruce is confined to warmer, protected areas, such as alluvial plains and water margins, and the slopes of eskers and kames. Fire brings white birch into temporary prominence on sites not dominated by jack pine. White birch normally exists as scattered individuals throughout the coniferous forest. Tamarack pioneers on lowland areas after a fire. Lichen woodlands tend to experience a burning rate of one fire every 150 to 200 years. Stands older than 200 years are quite common.

Rock lichen vegetation is commonly interspersed within lichen woodlands, occupying the upper, dry slopes of prominent bedrock outcrops. As the name implies, a range of lichens cover the rock surfaces. Only the occasional black spruce or jack pine, growing in the bedrock fissures, are present. After a fire, most successional change is confined to lichens, mosses and herbs, as they invade and respond to shading that accompanies regeneration and growth of the dominant trees.

The typical peatlands are peat plateaus, or raised permafrost bogs. These peat plateaus are bordered by open water or fen on the wet lowland side and by a narrow strip of forested shallow peat that abruptly changes into lichen woodland on the dry upland mineral soils. The sphagnum moss that forms the peat tends to grow in mounds; hence, the peatland surfaces are hummocky. When mosses die, due to fire or climatic extremes, a dense mat of lichens sometimes covers the entire surface.

Black spruce and dwarf birch may occur on the peat plateau, or it may be treeless due to fire or to harsh climate. The treeless condition, termed "palsas," becomes common as the climate becomes more severe toward the northeast. Treeless plateaus are lichen-covered and polygonally patterned by ice-wedge fissures. The lichen cover indicates a current lull in peat building, possibly due to surface drying as the ice-wedge fissures deepen in response to climate change.

On level landscapes, the peat plateau surfaces are usually pitted with melt-out hollows where pools support various sedges. On sloping terrain, water drains downslope, forming "fen tracks" that give a rilled appearance to the plateau. Tamarack borders these fen tracks, and sedge, bulrush and cotton-grass grow within them.

Sedge fens, composed of sedge, cotton-grass and bulrush, occupy very poorly-drained depressions.

Lakeshores are characterized by narrow, marginal mats of aquatic vegetation composed of large sedges and bur-reeds. Shrubs such as green alder, willow and dwarf birch encroach along the water edge.

Several arctic plants can be found in the northeast corner of the province, namely alpine azalea, false asphodel and northern grass-of-parnassus.

Plants, shrubs and trees of the ecozone are listed in Appendix 4, along with their global and provincial status.

Open lichen woodland in winter (and moose). Tim Trottier

Lichens (continued)

coniferous forests. Caribou have micro-organisms in their stomachs to help them digest lichens, which, although poor in protein, provide the carbohydrates that caribou need to generate body heat.

Reindeer lichens were also used by Aboriginal peoples for medicinal teas to expel intestinal worms and to treat colds, arthritis, fevers, jaundice, convulsions, constipation, coughs and tuberculosis. Although humans cannot digest lichens, Aboriginal peoples often ate partially digested lichen from caribou stomachs. Lichen had great nutritional value in this partially digested state. It was eaten fresh and warm (it is said to taste like a fresh lettuce salad) or mixed with blood, fat and meats to make a pudding.

Lichens absorb nutrients and moisture directly into their cells from atmospheric precipitation and from dustfall. This is very different from flowering plants and conifers, which absorb water and nutrients primarily through their root systems. As a result, lichens are directly exposed to toxins found in rain or snow. These toxins may originate either from the natural environment (background levels) or from human-caused atmospheric pollution. As such, they are good indicators of the quality of air and are often used to monitor air quality in industrialized areas or track long-distance transport of atmospheric pollutants.

LICHENS

Lichens have the ability to survive under stressful conditions such as extreme cold and drought. In the Taiga Shield Ecozone they can grow where few other plants can, such as on rock surfaces and on the trunk and branches of trees. They are well suited to subarctic and arctic environments because they can grow in low temperature and light and are not damaged easily by frost. When environmental conditions are not optimal for growth, they become dormant until more favourable conditions return.

Lichens are a unique combination of algae and fungi. In this symbiotic relationship, the fungus provides a substratum or structure on which the algae live. The algae photosynthesize, creating the energy compounds that feed both the algae and the fungal partner. There are many forms of lichens: tiny crustose lichens that grow principally on rock, larger foliose lichens that grow on soils or trees and fruticose lichens, such as reindeer lichen (Cladina sp.) that resemble miniature trees or shrubs and usually grow on soils or rotting wood. Differences in the chemical make-up of the fungal partner are responsible for the colour differences among lichen species. At lease 137 species of lichens are known to exist in the Taiga Shield Ecozone: one-half of the species are fruticose, while crustose and foliose lichens each comprise about one-quarter of the species found.

Reindeer lichens, often called reindeer moss, of the genus Cladina, are the most important winter food for caribou and musk oxen. These lichens commonly form extensive carpets over the ground in open

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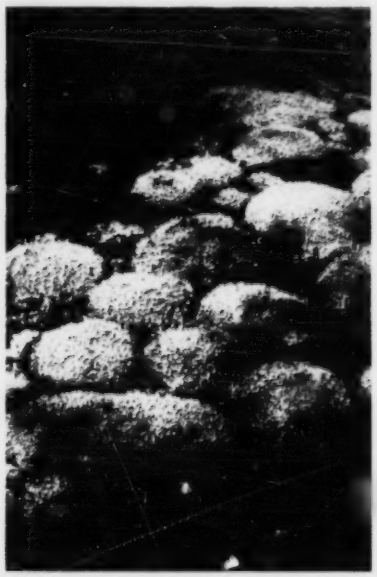
ecosystems. While medium to tall, closed stands of trembling aspen, white birch and balsam poplar are common after a fire, they are a minor component of the forest. White spruce, balsam fir and black spruce occur in late successional stages.

The peatlands are dominated by sedge fen, which are composed of sedges, cotton-grasses, horsetails and bulrushes. Shrubs, with willows, green alder and dwarf birch predominating, are found around the margins of the fens.

The peat plateaus are wooded, covered with low open stands of black spruce, or mixed stands of black spruce and tamarack. Peat, or sphagnum moss, is the main groundcover, interspersed with common and narrow-leaved Labrador tea, bog cranberry and cloudberry. In areas that are very poorly-drained, sedge-dominated fens are associated with tamarack. The permafrost is less extensive than in the Selwyn Lake Upland Ecoregion, and no polygonally patterned peat plateaus exist. However, the peatlands do display thermokarst features such as melt-out pools, which are less acidic than the peat plateau itself. The vegetation associated with these includes various sedges and bulrushes, dwarf birch and tamarack.



Cushion-like colonies of lichen (Stereocaulon sp. and Cladina mitis) grow on sandy soil in a jack pine forest. Robert A. Wright

The rock lichen woodland occurs on very shallow till veneers, where droughty conditions are common. A very open stand of stunted jack pine grows in local pockets of glacial drift and in bedrock fissures, while the surrounding bare rock is covered with rock lichens. Along bedrock fractures, where soil is deeper, there is increased diversity of shrubs, lichens and mosses.

The vegetation of the **Selwyn Lake Upland Ecoregion** is fairly uniform and simple compared to that of other ecoregions, because of the subarctic climate. Lichen woodland, rock lichen, peatlands (peat plateaus, palsas and sedge fens) and boreal wetlands are the major vegetation associations.

Open lichen woodland is characterized by stunted black spruce scattered in an open, park-like setting, with a ground cover of yellowish to whitish colored lichens, interspersed with dwarf shrubs. On wetter slopes, the trees are much closer together, and vascular plants and mosses become a significant component in the groundcover. The trees in this ecoregion are small for their age, a result of the harsh climate and short growing season.

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Lichens (continued)

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CARIBOU

The Taiga Shield Ecozone is perhaps best known for the large herds of migratory caribou which winter in northern Saskatchewan. Caribou are members of the deer family and are slightly larger than white-tailed deer. Adult male caribou weigh approximately 145 kg. An adult female caribou weighs an average of 90 kg and has antlers, unlike other female members of the deer family. Only the woodland caribou and barren-ground caribou are found in Saskatchewan.

Barren-ground caribou differ from the more southerly distributed woodland caribou in that they are smaller, somewhat lighter in color and undertake long migrations from their summer calving grounds in the NWT and Nunavut to their wintering grounds below the tree-line. They also aggregate in herds numbering in the thousands for most of the year, while woodland caribou associate in small bands. In Saskatchewan, barren-ground caribou are found in the Taiga Shield and northern Boreal Shield ecozones, while the woodland caribou live primarily in the Boreal Plain and Boreal Shield ecozones. Some woodland caribou can be found in the western part of Saskatchewan's Taiga Shield Ecozone.

Last surveyed in 1994, the Beverly and Qamanirjuaq herds of barren-ground caribou were estimated at 276,000 and 496,000 animals, respectively. These herds migrate from the tundra to the sparsely treed northern coniferous forests, known as taiga, during most winters. In the spring, caribou make their way north on the Arctic mainland, where they give birth. After calving, caribou will group in herds of up to 30,000 as protection against insects, breaking up only when this harassment abates. Caribou regroup in the fall to begin the migration back to the taiga. The rut occurs in late October.

Theories that try to explain the migration of caribou involve food, predation, insects and weather.

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Sedge fen on the east shore of Misaw Lake. Sedges (Carex spp.) are the most common type of aquatic emergent plants in the Taiga Shield Ecozone. Robert A Wright

2.2.3 Fauna

Considered by many as the "edge of the Arctic," the **Taiga Shield Ecozone** of Saskatchewan boasts a number of wildlife species usually found in abundance much farther north. Species such as the arctic fox, willow ptarmigan, snowy owl and barren-ground caribou either winter in the ecozone or are regular visitors. Although officially extirpated from Saskatchewan, the barren-ground grizzly has recently been recorded in northern Manitoba and individuals may occasionally range into the Taiga Shield Ecozone of Saskatchewan. Recently, a confirmed sighting of a polar bear was reported at Burnett Lake near the Saskatchewan-Manitoba border on the 59th parallel. This is the first such confirmed report for Saskatchewan.

Wildlife populations in the Taiga Shield Ecozone are relatively sparse compared to more southern areas, reflecting lesser diversity of plant life and habitat. Wildlife diversity is low because of the harsh environment created by adverse climate, sandy, shallow soils and high fire frequency. Approximately 50 mammal species have been reported to occur in

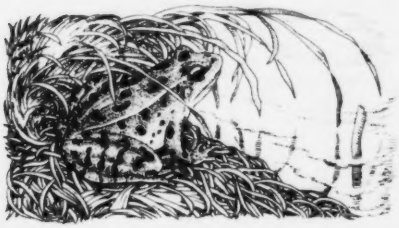
Wolves and caribou

the ecozone. In addition to those already mentioned, snowshoe hare, gray wolf, red fox, wolverine, marten, lynx, beaver, masked shrew, least chipmunk, red-backed vole and red squirrel occur in this ecozone.

Richness of bird species is also low, with 120 species reported to occur in this ecozone. Representative birds include spruce grouse, gray jay, boreal chickadee, pine grosbeak, ruby-crowned kinglet, gray-cheeked thrush, Harris' sparrow, American tree sparrow, white-crowned sparrow, blackpoll warbler and golden eagle. Diversity of bird species may exceed that reported because of the lack of research studies and records for this remote area.

There are only 22 fish species inhabiting the waters of this ecozone, including game fish such as walleye, northern pike, lake trout and arctic grayling. In addition to these species there are whitefish, cisco, sculpin, suckers, dace, shiners, sticklebacks, chub, trout-perch and burbot. Rainbow trout were stocked in the past in several lakes near Uranium City. There is one species of fish found in this ecozone that is identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as threatened – the shortjaw cisco.

Only three amphibians are known to occur in this ecozone: the northern leopard frog, boreal chorus frog and wood frog.



Northern leopard frog

The invertebrate fauna of the Taiga Shield Ecozone are not well known, either in aquatic or terrestrial habitats. It is known that insects and other invertebrates are an important segment of

Red squirrel

forest biodiversity and play a significant role in the ecosystem as pollinators, sources of food, and agents of decay. Likewise, aquatic invertebrates serve a similar variety of ecological roles, not the least of which is food for fish.

In the **Tazin Lake Upland Ecoregion** wildlife populations are low, but there is a larger number of species here than in the Selwyn Lake Upland Ecoregion, due to greater diversity of plant communities. It is estimated that 39 mammal species occur in this ecoregion. Barren-ground caribou migrate into the ecoregion but not in the same numbers as in the Selwyn Lake Upland Ecoregion. Other mammals include the beaver, snowshoe hare, red squirrel, red-backed vole, meadow jumping mouse, northern bog lemming and ermine. Large predators include the gray wolf, wolverine, marten, lynx, arctic fox and red fox.

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Caribou (continued)

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Caribou are well adapted to live in cold climates. Their hair has a network of large, honeycomb-like cells that trap air and act as an excellent insulator. Air is also trapped between their densely packed hair. This hollow hair and short ears and tail allow caribou to tolerate extreme cold. Caribou are also very good swimmers and their large, cloven hooves function well as paddles.

The barren-ground caribou diet consists mainly of terrestrial lichens, i.e., "reindeer moss," and shrubs (dwarf willow and birch) in the winter, which are gradually replaced by grasses and sedges during the summer. Caribou have an excellent sense of smell which they use to locate lichens under the snow. As winter snows deepen, caribou will scrape away more than a metre of snow with their hooves, creating "craters" to access the lichens.

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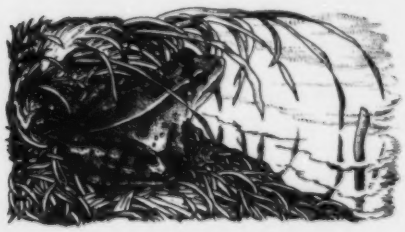

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PTARMIGAN

The willow ptarmigan, Lagopus lagopus, comes south to northern Saskatchewan in the winter from their breeding ground in the NWT and Nunavut.

Willow ptarmigan are a type of grouse and weigh from 450-600 g. They have feathered feet, which improves their ability to walk in snow and provides insulation.

Unlike most birds, ptarmigans have three seasonal plumages per year instead of two. In winter, willow ptarmigan are basically white (although their tail feathers remain black throughout the year). In the spring, as soon as the snow begins to melt, the females moult into a barred breeding plumage of brown, gold and black. The breeding males delay their moult and are distinctive with their chestnut heads, necks and chest, while the remainder of their bodies are still white. In the summer, the entire bird, except for the lower abdomen and wings is a chestnut brown in color.

In the summer, willow ptarmigan can be found in tree-line areas, arctic valleys and coastal tundra where vegetation is relatively lush and tall. They prefer moist areas, such as pond edges, streamside thickets and marshy tundra. In the late fall, ptarmigans seek more protected areas and move southward into the taller vegetation of more dense shrubs and forested areas.

Ptarmigans are generally considered monogamous. Male willow ptarmigan, however, are the only family-conscious fathers in the grouse group. Other male ptarmigans will, at the beginning of incubation, guard their females, but they eventually lose interest and leave their mates to complete the incubation and rear the brood on their own. The male willow

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White-winged crossbills

birds that breed in the area include the surf scoter, arctic tern, mew gull, common redpoll and greater yellowlegs. Those species that nest here but have a wider distribution than this ecozone include the golden eagle, yellow warbler, horned lark, white-winged crossbill, dark-eyed junco, blackpoll warbler, olive-sided flycatcher and Bohemian waxwing. The willow ptarmigan, rock ptarmigan and gyrfalcon winter in the area.

There is a low level of species richness of fish, with 21 species in the Tazin Lake Upland Ecoregion. Species include northern pike, walleye, lake trout, lake whitefish, yellow perch, goldeye, arctic grayling, cisco, lake chub, emerald shiner, spottail shiner, trout-perch, slimy sculpin and ninespine stickleback.

The three amphibians of record in this ecoregion are the northern leopard frog, boreal chorus frog and wood frog.

In the **Selwyn Lake Upland Ecoregion**, wildlife populations are also low, due to the severe climate and resulting low vegetation diversity. There have been 15 mammal species reported in this ecoregion. Barren-ground caribou winter here most years. Other mammals include snowshoe hare, red-backed vole, red fox, arctic fox, wolverine, marten, gray wolf and mink.

Birds such as spruce grouse, willow ptarmigan, gray jay, boreal chickadee and common raven live here year-round. The surf scoter, mew gull, arctic tern and least sandpiper nest here but rarely elsewhere in the province. Other birds include the osprey, sandhill crane, Harris' sparrow, American tree sparrow, gray-cheeked thrush, pine grosbeak, ruby-crowned kinglet, white-crowned sparrow and blackpoll warbler.

There are only 18 species of fish, including lake trout, arctic grayling, northern pike, lake whitefish, cisco, burbot and white sucker.

The two amphibians of record are the wood frog and boreal chorus frog.

Wood frogs are the most common amphibians of the Taiga Shield Ecozone. While these animals reproduce in water, they tend to be more of an upland species than the leopard frog. Robert A. Wright

Appendix 3 lists the provincial and COSEWIC rankings for status of species, in terms of their occurrence. The fauna of the Taiga Shield Ecozone are listed in Appendix 5, along with their global and provincial status.

2.3 The Cultural Environment

2.3.1 Human Heritage and Settlement

At the time of European contact, the Taiga Shield Ecozone was occupied by people of the Chipewyan language group. Unlike their Cree neighbors to the south who were generalized hunters of the boreal forest, Chipewyan peoples subsistence centered almost exclusively on migratory barren-ground caribou. They followed the caribou north to the tundra of the NWT during summer and returned with the herds to the (transitional) forests in winter. They were continuing a pattern of settlement and subsistence, based on hunting migratory caribou, that had remained more or less unchanged for thousands of years and which very much characterizes the entire human history and use of the Taiga Shield Ecozone.

The earliest occupation of this ecozone occurred between 8,000 and 7,000 years ago. These first barren-ground caribou hunters, the Northern Agate Basin people, are known from their use of well-fashioned lanceolate-shaped spear points (several of which have been found around Lake Athabasca and Wollaston Lake). They were succeeded, in turn, by the next caribou hunters, the Shield Archaic people, who occupied the land between 6,000 and 3,500 years ago. The projectile point of these first northern caribou hunters shows a marked similarity with those of even earlier bison hunters far to the south. This has led some to suggest that the Northern Agate Basin and Shield Archaic peoples may actually have had their origins on the plains, either through a direct movement of people northward during the milder climatic conditions that prevailed (4,500 to 8,500 years ago), or through the diffusion of ideas about hunting herding animals.

Around 3,500 years ago the climate became significantly colder. As the tree line moved farther south so too did the Aboriginal peoples who occupied these northern forests. At this time as well, early Inuit peoples (called Pre-Dorset) moved south from the Arctic, no doubt following caribou which now migrated much farther south into northern Saskatchewan. The distinctive stone tools of the Pre-Dorset people, including very small, well-made blades and specialized bone-working tools, have been found at several sites along Lake Athabasca and Black Lake.

By 2,500 years ago the climate had warmed, the tree line moved north once again, and the Aboriginal peoples returned to occupy the area of the Taiga Shield Ecozone. Archaeologists assign the stone tool technology of these people to the Taltheilei Tradition. This tradition is best known from Great Slave Lake and other northern regions, where it has been identified with the eastern Dene (Athapaskan). Peoples of the (late) Taltheilei Tradition (between approximately 750 and 250 years ago) were probably the direct ancestors of the historic Chipewyan language group and Yellowknife people. Their archaeological remains have been found as far south as the Churchill River, which coincides with the extreme southern limit of the barren-ground caribou migration.

Because the Taiga Shield Ecozone has received only limited archaeological exploration and research (perhaps due, in part, to its remoteness), the archaeological record of the pre-European contact history of this region is not well documented. Presently, fewer than 100 archaeological sites are known. Most consist of light to moderate scatters of stone tools and other artifacts, which likely represent small domestic campsites and hunting localities. Although few in number, these archaeological sites are important, as they often provide the only material evidence to understand the life ways of ancient northern peoples and the processes that influenced cultural change over time.

European influence came with the fur trade. Peter Fidler, an independent fur trader, arrived in 1791. Fur trading companies established their presence

Ptarmigan (continued)

ptarmigan, however, guards his mate closely during the entire incubation period of about three weeks and helps in the rearing of the young. Ptarmigan chicks are precocial (can feed themselves as soon as they hatch). They grow amazingly quickly and can run and fly within a week. By autumn they are almost adult in size and are able to fend for themselves.

Like other grouse, ptarmigans eat mostly plants. In the summer, their diet might consist of leaves, buds, flowers, seed capsules, bulblets and a wide variety of berries. They also eat insects and, when available, insects and spiders. In the winter, their choice of food is limited to the few plants found above the snow or in windswept places. They will eat the seeds, buds and twigs of low willows, alders and dwarf birches. To be able to reach the buds on trees and shrubs, the willow ptarmigan has learned to perch, somewhat unsteadily, on thin branches.

The ptarmigan, as well as animals such as snowshoe hares, lemmings, lynx, red and arctic foxes and snowy owls, undergo cyclical population fluctuations. There is no single explanation that applies to all cases. Weather conditions and quality and quantity of food appear to be factors that contribute to the rising and falling of populations, which occur at fairly regular intervals. □

Willow ptarmigan

PTARMIGAN

The willow ptarmigan, Lagopus lagopus, comes south to northern Saskatchewan in the winter from their breeding ground in the NWT and Nunavut.

Willow ptarmigan are a type of grouse and weigh from 450-800 g. They have feathered feet, which improves their ability to walk in snow and provides insulation.

Unlike most birds, ptarmigans have three seasonal plumages per year instead of two. In winter, willow ptarmigan are basically white (although their tail feathers remain black throughout the year). In the spring, as soon as the snow begins to melt, the females moult into a barred breeding plumage of brown, gold and black. The breeding males delay their moult and are distinctive with their chestnut heads, necks and chest, while the remainder of their bodies are still white. In the summer, the entire bird, except for the lower abdomen and wings is a chestnut brown in color.

In the summer, willow ptarmigan can be found in tree-line areas, arctic valleys and coastal tundra where vegetation is relatively lush and tall. They prefer moist areas, such as pond edges, streamside thickets and marshy tundra. In the late fall, ptarmigans seek more protected areas and move southward into the taller vegetation of more dense shrubs and forested areas.

Ptarmigans are generally considered monogamous. Male willow ptarmigan, however, are the only family-conscious fathers in the grouse group. Other male ptarmigans will, at the beginning of incubation, guard their females, but they eventually lose interest and leave their mates to complete the incubation and rear the brood on their own. The male willow

continued on the following page

White-winged crossbills

birds that breed in the area include the surf scoter, arctic tern, mew gull, common redpoll and greater yellowlegs. Those species that nest here but have a wider distribution than this ecozone include the golden eagle, yellow warbler, horned lark, white-winged crossbill, dark-eyed junco, blackpoll warbler, olive-sided flycatcher and Bohemian waxwing. The willow ptarmigan, rock ptarmigan and gyrfalcon winter in the area.

There is a low level of species richness of fish, with 21 species in the Tazin Lake Upland Ecoregion. Species include northern pike, walleye, lake trout, lake whitefish, yellow perch, goldeye, arctic grayling, cisco, lake chub, emerald shiner, spottail shiner, trout-perch, slimy sculpin and ninespine stickleback.

The three amphibians of record in this ecoregion are the northern leopard frog, boreal chorus frog and wood frog.

In the **Selwyn Lake Upland Ecoregion**, wildlife populations are also low, due to the severe climate and resulting low vegetation diversity. There have been 15 mammal species reported in this ecoregion. Barren-ground caribou winter here most years. Other mammals include snowshoe hare, red-backed vole, red fox, arctic fox, wolverine, marten, gray wolf and mink.

Birds such as spruce grouse, willow ptarmigan, gray jay, boreal chickadee and common raven live here year-round. The surf scoter, mew gull, arctic tern and least sandpiper nest here but rarely elsewhere in the province. Other birds include the osprey, sandhill crane, Harris' sparrow, American tree sparrow, gray-cheeked thrush, pine grosbeak, ruby-crowned kinglet, white-crowned sparrow and blackpoll warbler.

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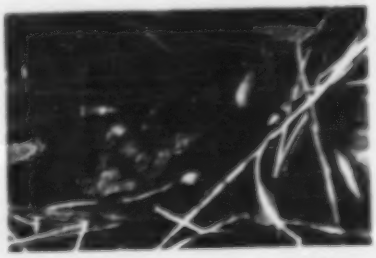

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Willow ptarmigan

THE POLAR BEAR - A RARE VISITOR TO THE SASKATCHEWAN NORTH

On September 4, 1999, a group of American visitors on a fishing trip to Burnett Lake near the Saskatchewan-Manitoba border on the 59th parallel enjoyed a rare wildlife viewing opportunity. After fishing for some time, the group was shocked to discover a very inquisitive and perhaps very hungry polar bear swimming after their small boat. The group took some quick video footage before wisely deciding to put more distance between themselves and the bear. Burnett Lake is almost 400 km from the shores of Hudson Bay, the polar bears' normal range during the summer months when the sea ice is out. While polar bears have likely ventured into Saskatchewan before, this rare sighting is the first documented and contributes to our further understanding of polar bear movement. ❑

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2.3.2 Demographics

There are four communities in the Taiga Shield Ecozone: Uranium City, Camsell Portage, Fond-du-Lac and Wollaston Lake.

A number of First Nations and northern municipal communities are located in the Athabasca Basin, the area around Lake Athabasca (Table 1), which includes territory in the Boreal Shield and Taiga Shield ecozones. The Fond du Lac and Black Lake First Nations have communities and reserve lands found in both of these ecozones (Table 2 and Figure 5). The four northern municipal communities situated in the Athabasca area are the Northern Hamlet of Stony Rapids and the Northern Settlements of Uranium City, Wollaston Lake and Camsell Portage. Although Stony Rapids is in the Boreal Shield Ecozone, it has close ties with the communities of the Taiga Shield Ecozone.

Traditional Dene summer camp circa 1900. Beverly and Qamanirjuaq Caribou Management Board

The population of the Athabasca Basin consists generally of individuals of Dene, Cree, Métis and European ancestry. According to population statistics collected in 1999, approximately 3,444 people resided in the Athabasca Basin during that year.

Table 1 provides an overview of the population of the individual communities and First Nations situated in the Basin. Fond-du-Lac and Wollaston Lake are in, or partially in, Indian reserves and it is difficult to separate their population numbers from the resident reserve population. There are no population figures for the communities of Fond-du-Lac or Black Lake.

The average age of the population of the Taiga Shield Ecozone is young as there are high local birthrates. Just under 40% of the approximately 1,300 people in the ecozone are less than 15 years of age, compared to about 22% for the Saskatchewan population as a whole.

Aerial view of Fond-du-Lac, 1957. Saskatchewan Archives Board, Photograph #R- B6719 (1)

2.3.3 *Indian Reserves*

When Saskatchewan was being settled near the turn of the last century, five treaties were signed by the federal government and the First Nations in western Canada. These treaties provided for the continuation of traditional lifestyles and included promises of a land base on which to live. Table 2 lists the reserves in the Taiga Shield and Boreal Shield ecozones. Figure 5 shows the locations of these Indian reserves.

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Northern Settlement of Uranium City**	201
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Total Athabasca Region	**3,444**

Footnote:

*Fall 1999 on-reserve population statistics for the Fond du Lac, Black Lake and Hatchet Lake First Nations collected by the Department of Indian Affairs and Northern Development (DIAND). These statistics include Status Treaty and non-Aboriginal individuals who live on reserve, but do not include those individuals who are considered transients.

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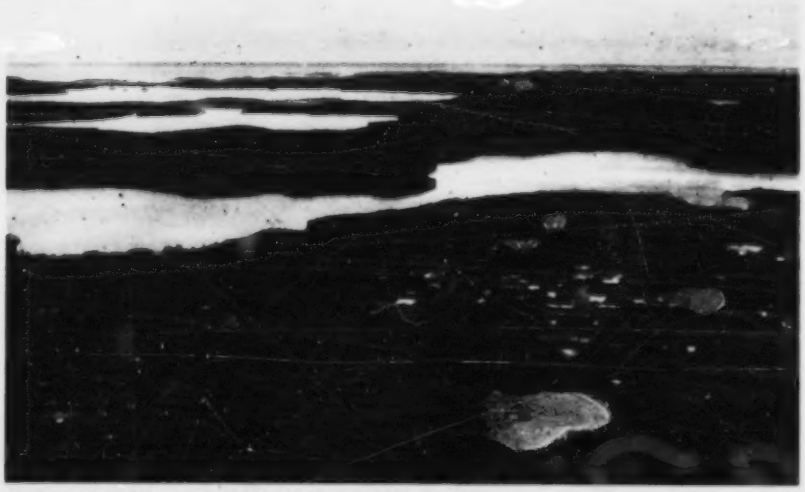
The main population centre of the Black Lake First Nation is the community of Black Lake, situated in the southern portion of Indian Reserve #224 near the location where the Fond du Lac River flows into Black Lake. Many members of this First Nation also reside in the neighboring community of the Northern Hamlet of Stony Rapids, which is linked to Black Lake by a 17 km dirt road constructed during the 1950s.

The Black Lake First Nation is a signatory to Treaty 8. The traditional territory of the membership of the Black Lake First Nation is the area around these two community centres, extending both to the south and to the north into the NWT.



Uranium City, looking south to Lake Athabasca, 1985. Tim Trottier

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This First Nation's main population centre is the community of Fond-du-Lac situated along Lake Athabasca's north shore in Indian Reserve #227. The traditional lands of the Fond du Lac First Nation stretch to the west along the south shore of Lake Athabasca to the Alberta border; south to the Old Fort River; east to Minto, Dunning, Mayson and Pipestone Lakes; and north up the Pipestone River to Thomson and Riou lakes. The traditional lands will also extend into the NWT. The Fond du Lac First Nation is a signatory to Treaty 8.

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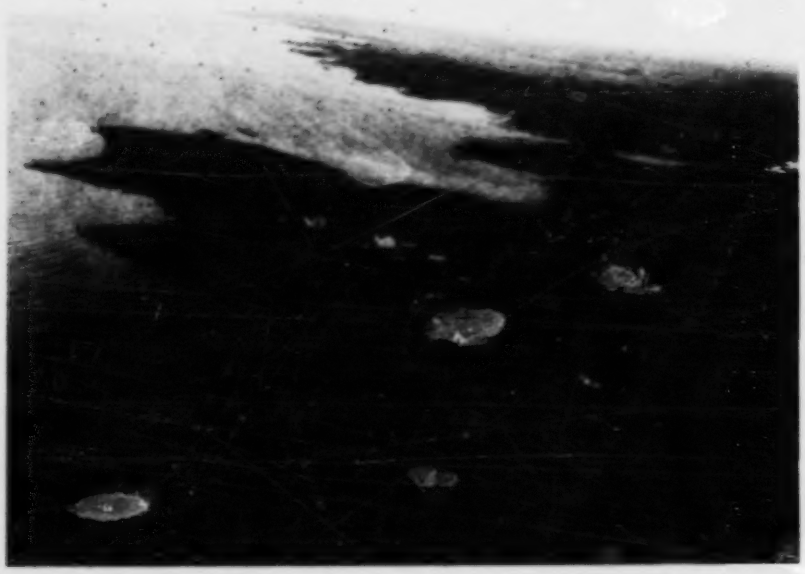

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Table 2 First Nations and Indian Reserves in the Taiga Shield Ecozone

First Nations	Treaty Signing # (Year)	*Resident Population	Language	Economic Base	Indian Reserves Located in the Taiga Shield Ecozone: Indian Reserve Numbers	Area (ha)
Fond du Lac	8 (1889)	729 (Reserves 227, 228, 229, 231, 232, 233)	Athapaskan Linguistic group - Chipewyan	Trapping	Fond du Lac 227 (majority of the resident population) Fond du Lac 229	15,520.00 7,821.10 23,341.10
Black Lake	8 (1889)	1,024 (Reserves 224 [majority of the resident population, in the Boreal Shield Ecozone], 225, 226)	Athapaskan Linguistic group - Chipewyan	Fishing and trapping	Chicken 224 (part of) Chicken 225 Chicken 226	Unavailable 2,183.40 4,216.90 6,400.30
Hatchet Lake	10 (1907)	1,088	Athapaskan Linguistic group- Chipewyan	Trapping and commercial fishing	Lac La Hache 220	11,020.00
Totals		**2,841**				**40,761.40**

*Footnote: * Total on reserve population includes core band, other band and non-registered persons. These numbers do not necessarily reflect members of service agencies and their families, living in the communities (e.g., RCMP, Health Canada, educational staff, etc.).*

Source: DIAND, 2000.

2.3.3.3 Hatchet Lake First Nation

The reserve land of the Hatchet Lake First Nation is the Lac La Hache Indian Reserve #220 situated along the eastern shore of Wollaston Lake in the Tazin Lake Upland Ecoregion of the Taiga Shield Ecozone. Historically, the Hatchet Lake First Nation was located northwest of Wollaston Lake in the vicinity of Hatchet Lake. Today, the main population centre of this First Nation is located at the southwest end of Indian Reserve #220 in the community of Wollaston Lake, which is a dual community that consists of two components, the reserve community of the Hatchet Lake First Nation and the Northern Settlement of Wollaston Lake. The reserve community was moved to the Wollaston Lake location in 1970.

The Hatchet Lake First Nation signed Treaty 10 in 1907. There are strong ties between the membership of the Hatchet Lake First Nation and the Dene people of Lac Brochet in Manitoba. This is likely due to linkages to traditional caribou migrations down the Manitoba/Saskatchewan border. This was also reinforced by the fur trade, with its travel route from the NWT down Reindeer Lake to the Churchill River and the trading posts located at both communities.

2.3.3.4 The Métis

Historically, the Métis groups in this ecozone are descendants of marriages between European and Aboriginal peoples during the fur trade, both locally and as the result of migration from Métis settlements on the plains to the south. Many of these people have taken Treaty status after the signing of Bill C-31. Various groups of Métis have moved to this area in later years, such as to Stony Rapids in the 1920s. More recently, Métis have moved here from Prince Albert, La Ronge, Pinehouse and Buffalo Narrows.

Family names of local descendants include MacDonald, Mercredi and Robillard. Family names of migrants from the plains include Powder, LaRoque, Augier and Shott in the Camsell Portage/Uranium City area, and Hansen in the Wollaston Lake area.

There are Métis Nation of Saskatchewan (MNS) locals and elected representatives in Uranium City, Camsell Portage, Stony Rapids and Wollaston.

2.3.4 Human Health and the Physical Environment

Environment is one of the key components of the determinants of health of the human population. The impact of the physical environment on human health can be direct and physical, as is the case in

Table 2 First Nations and Indian Reserves in the Taiga Shield Ecozone

First Nations	Treaty Signing # (Year)	*Resident Population	Language	Economic Base	Indian Reserves Located in the Taiga Shield Ecozone: Indian Reserve Numbers	Area (ha)
Fond du Lac	8 (1889)	729 (Reserves 227, 228, 229, 231, 232, 233)	Athapaskan Linguistic group - Chipewyan	Trapping	Fond du Lac 227 (majority of the resident population) Fond du Lac 229	15,520.00 7,821.10 23,341.10
Black Lake	8 (1889)	1,024 (Reserves 224 [majority of the resident population, in the Boreal Shield Ecozone], 225, 226)	Athapaskan Linguistic group - Chipewyan	Fishing and trapping	Chicken 224 (part of) Chicken 225 Chicken 226	Unavailable 2,183.40 4,216.90 6,400.30
Hatchet Lake	10 (1907)	1,088	Athapaskan Linguistic group- Chipewyan	Trapping and commercial fishing	Lac La Hache 220	11,020.00
[illegible]		2,841				40,761.40

*Footnote: * Total on-reserve population includes own band, other band and non-registered persons. These numbers do not necessarily reflect members of service agencies, and their families, living in the communities (e.g., RCMP, Health Canada, educational staff, etc.).*

Source: DIAND, 2000

2.3.3.3 Hatchet Lake First Nation

The reserve land of the Hatchet Lake First Nation is the Lac La Hache Indian Reserve #220 situated along the eastern shore of Wollaston Lake in the Tazin Lake Upland Ecoregion of the Taiga Shield Ecozone. Historically, the Hatchet Lake First Nation was located northwest of Wollaston Lake in the vicinity of Hatchet Lake. Today, the main population centre of this First Nation is located at the southwest end of Indian Reserve #220 in the community of Wollaston Lake, which is a dual community that consists of two components, the reserve community of the Hatchet Lake First Nation and the Northern Settlement of Wollaston Lake. The reserve community was moved to the Wollaston Lake location in 1970.

The Hatchet Lake First Nation signed Treaty 10 in 1907. There are strong ties between the membership of the Hatchet Lake First Nation and the Dene people of Lac Brochet in Manitoba. This is likely due to linkages to traditional caribou migrations down the Manitoba/Saskatchewan border. This was also reinforced by the fur trade, with its travel route from the NWT down Reindeer Lake to the Churchill River and the trading posts located at both communities.

2.3.3.4 The Métis

Historically, the Métis groups in this ecozone are descendants of marriages between European and Aboriginal peoples during the fur trade, both locally and as the result of migration from Métis settlements on the plains to the south. Many of these people have taken Treaty status after the signing of Bill C-31. Various groups of Métis have moved to this area in later years, such as to Stony Rapids in the 1920s. More recently, Métis have moved here from Prince Albert, La Ronge, Pinehouse and Buffalo Narrows.

Family names of local descendants include MacDonald, Mercredi and Robillard. Family names of migrants from the plains include Powder, LaRoque, Augier and Shott in the Camsell Portage/Uranium City area, and Hansen in the Wollaston Lake area.

There are Métis Nation of Saskatchewan (MNS) locals and elected representatives in Uranium City, Camsell Portage, Stony Rapids and Wollaston.

2.3.4 Human Health and the Physical Environment

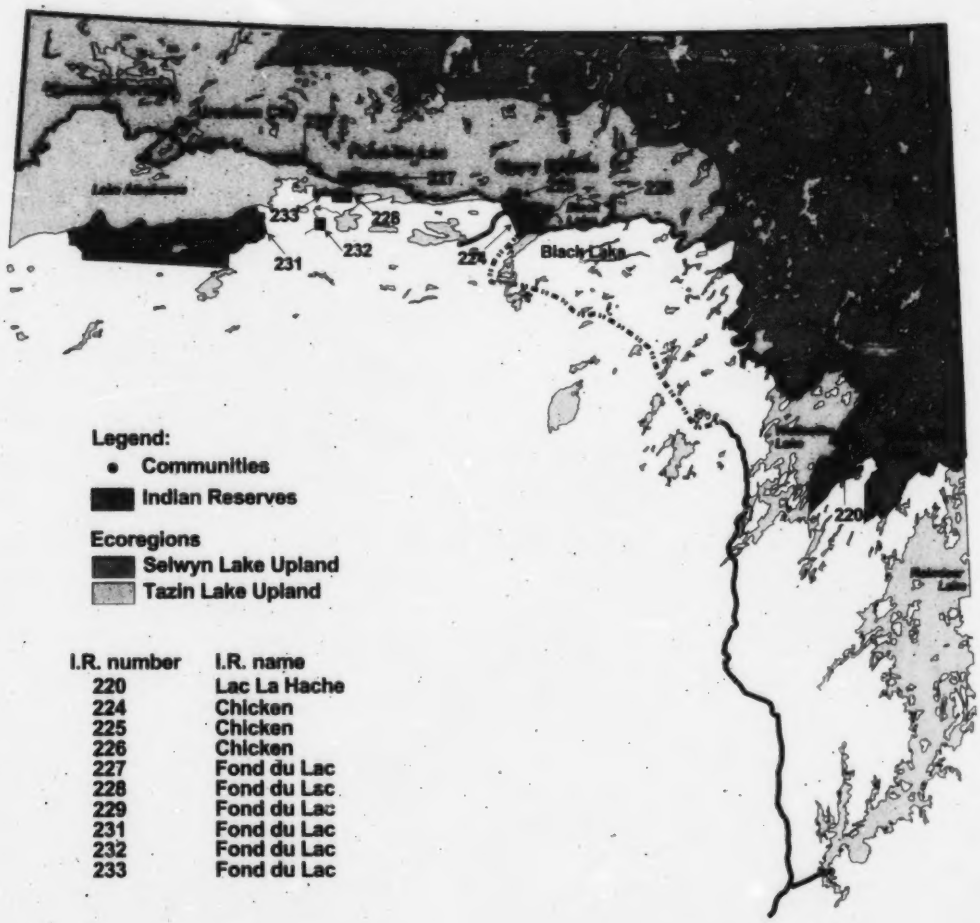
Environment is one of the key components of the determinants of health of the human population. The impact of the physical environment on human health can be direct and physical, as is the case in

environmental contaminants. The impact can also be indirect and non-physical, when the state of the environment affects the way of life within communities, and their social and psychological well-being. "Health is only possible where resources are available to meet human needs and where the living and working environment is protected from life threatening and health threatening pollutants, pathogens and physical hazards" (Veil, 1992).

There is more than just a direct physical relationship between the physical environment and physical health. There is a broad, holistic, more spiritual, link between harm to the environment and harm to the health and well-being of all life forms, including humans. In many dominant cultures, humans are a main component of the environment, whereas in Aboriginal cultures, humans are simply one aspect of the environment on equal footing with other forms of life. The people of the Taiga Shield Ecozone have a close connection to the land as they are still involved in traditional and subsistence lifestyles. They also have issues relating to income and social status, employment, education and housing. Environmental, social and economic concerns are all given equal consideration in making decisions about development and community issues.

The Taiga Shield Ecozone is now becoming more accessible with the development of the Athabasca Seasonal Road, which runs from Points North Landing to Black Lake. As the area isn't as remote at is once was, there are potential health, social and economic impacts, which can have either positive or negative implications.

Figure 5 Indian Reserves in the Taiga Shield Ecozone



I.R. number	I.R. name
220	Lac La Hache
224	Chicken
225	Chicken
226	Chicken
227	Fond du Lac
228	Fond du Lac
229	Fond du Lac
231	Fond du Lac
232	Fond du Lac
233	Fond du Lac

III Stresses: Use of the Taiga Shield Ecozone

3.1 Land Use

The land use and economy of the Taiga Shield Ecozone is based on its natural resources. Historically, by the late 1700s, fur traders had established trading posts along the major river systems in Saskatchewan. Because of the increased number of traders over vast areas, there was an increased need for maps, since local guides were not always available. In the early 1790s, Peter Fidler mapped the canoe route from Cumberland House to Lake Athabasca. This route traveled north through Reindeer and Wollaston lakes and followed much of the southern limit of the Taiga Shield Ecozone. Throughout the next 15 years, Fidler and David Thompson made detailed maps of the major drainages of Saskatchewan.

There were several fur trading posts in the Taiga Shield Ecozone. The first known trading post in the area was Grant's House, established in 1785. Grant's Tent was established in 1820. Both were found on the northern shore of Lake Athabasca near what is now the Alberta-Saskatchewan border. Fond du Lac I and Fond du Lac were established near the present-day community of Fond-du-Lac in 1805 and 1851, respectively. Black River was established in 1922. This trading post was located just to the west of present-day Stony Rapids. Other trading posts existed in the area. By the late 1800s, every community in the north that had a Hudson Bay trading post had at least one other fur trading competitor, and often more. Many of the documents recording information of these other trading posts have not survived. Only the trading posts of Fond du Lac and Black River continued after 1930.

One of the primary land uses in the ecozone has been mineral exploration and development. Although mineral exploration continues, there have been no minerals produced since 1982. Today, uses for the land centre around traditional resource use, commercial fishing, trapping and tourism. Tourism activities are primarily related to sport fishing, canoeing and scenic site viewing.

Subsistence hunting, trapping and fishing are still traditional and necessary activities for those who inhabit this land. Aboriginal peoples' occupancy of the Taiga Shield Ecozone has a very long tradition, and their cultural and economic well-being are dependent on continued access to the land and natural resources. Modern technology (snowmobiles) makes it easier for residents to travel out from settlements to engage in traditional land-based activities. In addition, traditional family camps and cabins are still well used on a seasonal basis.

Approximately 1,300 people live in this zone, or 0.1% of the Saskatchewan population. In comparison with more southerly ecozones, ecosystems in the Taiga Shield Ecozone are less biologically productive and diverse, the human population is smaller, and the area is not characterized by high levels of natural-resource development and use. Agriculture is virtually impossible and commercial forestry has a limited potential. Nonetheless, the economy of the ecozone combines a number of industrial activities that spring from the resources found in this area: gold; silver; base, platinum group and rare earth metals; and uranium. Small, local businesses support mineral exploration work in this zone. The network of roads is sparse compared to areas to the south. Consequently, there is a landing strip in almost every village. Most communities are accessible only by boat, snowmobile, air or by winter roads.

Leases and permits in this ecozone include: 33 commercial; 15 quarrying sand and gravel; 6 mineral surface; 32 miscellaneous use permits, which includes boat docks and traditional resource-use cabins; 26 recreational cabins; 3 institutional; 2 airstrips; and 4 government.

There are currently no parks or protected areas within this ecozone.

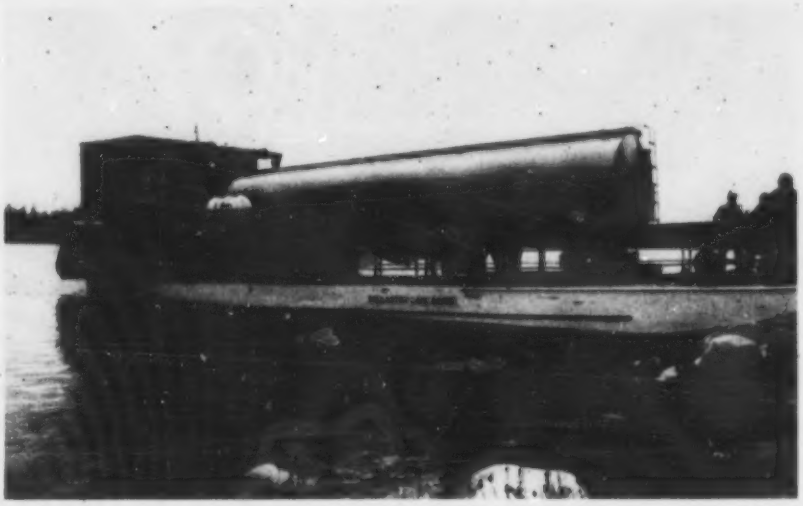
Fond du Lac post, Hudson Bay Company. Saskatchewan Archives Board, Photograph #R-A4857.

3.1.1 Transportation

Movement throughout the region was accomplished at first by canoe and dog team, and later by plane, barge and, to a limited extent, by automobile. A limited system of roads was constructed, providing access to airport, mine and barge sites. The roads were constructed to minimal standards with the road surface elevated only slightly above the existing topography.

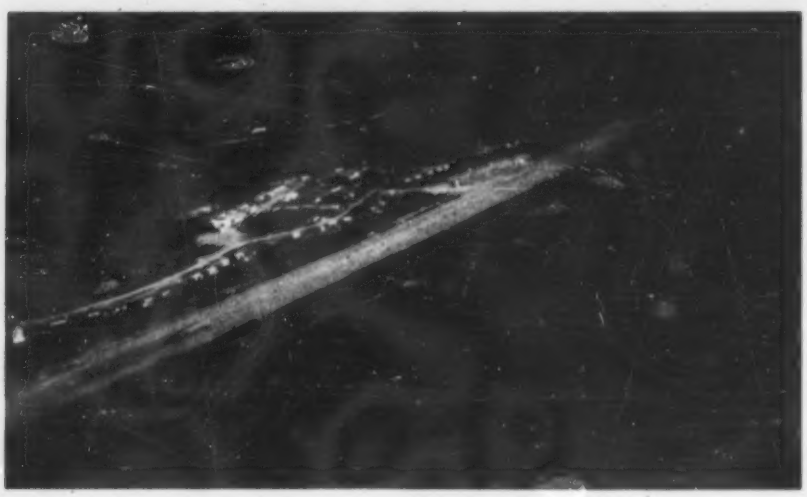
Traditional travel was mostly by water or by dog team in the winter. During the 1930s horse and team were introduced for freighting fish and furs from Lake Athabasca and the surrounding area. Freighting by horse did not last long because of the tremendous risks involved in crossing lakes and muskegs. Horses diedfrom exposure, exhaustion and from malnutrition due to lack of forage. The diet of the horses consisted of marsh hay and that which was hauled in on the voyage. The airplane and bush pilot eventually replaced horse and team.

The four provincial airports in the region are located in the communities of Camsell Portage, Fond-du-Lac, Uranium City and Wollaston Lake. Uranium City has the only paved (asphalt) runway and apron in the region. Fond-du-Lac has a treated gravel (gravel base structure that is double sealed) runway and apron, Camsell Portage has a gravel runway, and Wollaston Lake has a treated gravel runway and apron. Fond-du-Lac and Uranium City airports are both equipped with airport radio-controlled runway lighting systems (ARCAL) and transmitter beacons to assist in navigation. Camsell Portage is the only airport without scheduled air service.



Wollaston Lake barge at shore. Saskatchewan Highways and Transportation

The Taiga Shield contains less than 100 km of provincial roads, all of which are gravel surfaced. Black Lake (Boreal Shield Ecozone) and Fond-du-Lac are the only communities connected by an all-weather road. Camsell Portage has a rough, unbladed trail linking the community to the local airport; Fond-du-Lac and Uranium City both have dirt/gravel roads connecting the communities to the local airport and barge terminal; and Wollaston Lake has a trail connecting the community with the airport and ferry terminal. Current traffic on these roads is composed of light vehicles and all terrain vehicles (ATVs), with a few single axle and tandem trucks. Road use in the region has been primarily for the movement of people, but there may be a shift towards the movement of goods now that the Athabasca Seasonal Road connects Black Lake to Highway 905 at Points North Landing. Road use is increasing in almost all inhabited areas of the region, except for Uranium City, which is experiencing a decline.



Wollaston Lake airport. Saskatchewan Highways and Transportation

The population of the Taiga Shield Ecozone also depends heavily on barges, ferries and seasonal roads. Winter ice roads have long been constructed to allow transportation along and across Lake Athabasca. While the mines were operating, there was a winter road running north from La Loche and the Semchuck Trail, across Lake Athabasca to Uranium City. The winter of 1982-83 saw the last construction of the winter road linking Cluff Lake and Uranium City, which was open for approximately six weeks each season from approximately February 10 to March 24. Saskatchewan Highways and

Transportation maintains the ice roads constructed between Stony Rapids (Boreal Shield Ecozone), Fond-du-Lac and Uranium City, and across Wollaston Lake each winter. There may also be privately installed ice roads in various locations, or locations where people just drive down the lake to get from one point to another. Ice road operation is weather-dependent as a minimum amount of ice is required for safety. Construction is fairly simple: snow is cleared off the ice surface and on to the land where it is packed to promote frost formation. Ice roads typically function from mid-December to the end of March.

Privately owned barges have commonly been used to transport bulk supplies into the region. Currently, Camsell Portage, Uranium City and Fond-du-Lac all receive bulk goods barged in from Fort McMurray, Alberta during the summer. In the past, the Canadian Coast Guard was responsible for dredging the barge route and maintaining navigational aids on Lake Athabasca. The Coast Guard provided funding for the Athabasca Seasonal Road on the basis that they would no longer be required to dredge or maintain navigational aids on the lake. The intent of the Athabasca Seasonal Road is that goods will be trucked to Stony Rapids in the winter and then private barges will take the goods to Fond-du-Lac and Uranium City. This system of private barges has not been organized yet, so barges continue to operate from Fort McMurray, but with fewer trips.

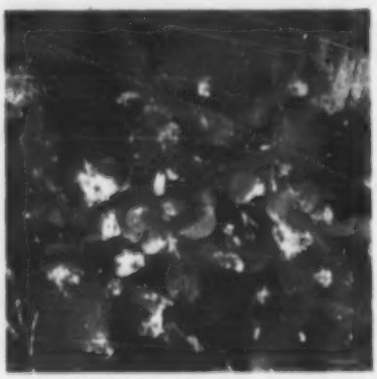
Perishable goods are flown in by airplane.

There are barge services on Wollaston Lake, as well as the only non-cable ferry in Saskatchewan.

3.1.2 Protected Areas

Saskatchewan is in the process of establishing a network of ecologically important land and water areas extending across the province's 11 ecoregions. These areas are termed representative areas and combined make up the Representative Areas Network (RAN). The RAN incorporates a wide range of natural features and reflects the diversity of landscape types found throughout the province. Representative areas are identified based on a number of scientific criteria, including geology, soils, climate, plants and animals, and are designated following public consultation and involvement. Human actions are restricted on these areas to allow natural ecological processes to be sustained. They can also serve as benchmarks or long-term reference points against which the impact of management practices being applied outside of these areas can be compared.

Three proposed representative areas in the Taiga Shield Ecozone include the Tazin Lake Representative Area (124,181 ha), the Chappuis\Fontaine Lakes Representative Area (319,653 ha) and the Misaw Lake Representative Area (341,343 ha). In cooperation with First Nations, trappers, other interest groups, individuals and other government land administering agencies, and as guided through a local advisory committee, SERM will finalize representative area locations and boundaries, address concerns or issues on a site-by-site basis, and outline actions and activities in a management plan or strategy for the area.



Arctic willow (Salix arctica) is typical of rocky, tundra-like openings near Hasbala Lake, in the proposed Misaw Lake Representative Area. Robert A. Wright

These representative areas, if approved, will be the first sites in the Taiga Shield Ecozone to receive any special form of protection. The sites represent important features specific to the northern latitude, where glaciation and weathering have resulted in spectacular landscapes. A diverse community of plants and wildlife specifically adapted to the cold northern climate characterize the three sites. Through regulations created under the *Ecological Reserves Act*, activities such as hunting, trapping, fishing or other "traditional" land uses are permitted and controlled within the sites. This is done to ensure that uses of the land that have helped shape the ecosystem and have been part of the northern lifestyle for generations are not radically changed.

Interim surface designations for a period of 10 years will be established for the proposed Tazin Lake and Chappuis/Fontaine Lakes sites in 2001. An interim designation will also be negotiated for a proposed area in the Misaw Lake area within a few years, once adequate geoscience information has been acquired through ongoing programs. The interim designations will allow time for a thorough public discussion and possible approval of the proposed sites by affected northern communities and stakeholder groups through land use planning processes. The period of 10 years will also provide time for geoscience and ecological information to be acquired on the proposed areas and will enable more informed decisions to be made. The level of geoscience information in the Misaw Lake area is particularly limited. To address this need, Saskatchewan Energy and Mines (SEM) initiated an integrated, multi-year geoscience program in 2000. Mineral exploration and research and development toward potential mine development will continue to be permitted in these areas. This will add to the information base and provide some potential economic initiatives for the areas.

Tundra-like vegetation at the summit of Arctic Butte, a large bedrock outcropping about 6 km east of the east side of Misew Lake. Alpine azalea (Loiseleuria procumbens) is a characteristic plant of this rocky tundra. Several lichen species new to Saskatchewan were found here by Forest Ecosystem Classification Project crews in 1998.
Robert A. Wright

If, through the public consultation process, these representative areas are approved, more permanent surface designations under the *Ecological Reserves Act* will be established. The designation of Crown Reserves by SEM may also be negotiated for approved sites. A Crown Reserve is a formal designation under *The Crown Minerals Act* that withdraws the minerals from future disposition for exploration and development.

If approved as currently proposed, the three representative areas will protect 785,177 ha or just over 16% of the Taiga Shield Ecozone. Public discussion and land use planning will continue before designation of all three representative areas in the ecozone. Capturing unique features characteristic of this most northern portion of the province, including important caribou habitat, remains a priority to ensure full representation of all landscape types within the provincial RAN.

3.1.3 Human Heritage

As physical and often inconspicuous components of the landscape, heritage sites are highly vulnerable to destruction from land development. This is especially true in the Taiga Shield Ecozone, where soils containing archaeological deposits, for example, are generally very shallow. Physical alterations to the land surface can adversely affect heritage sites by destroying cultural features, by removing artifacts and other vital data, or by mixing buried cultural deposits, thereby hindering proper stratigraphic analysis. Land use and development in the Taiga Shield Ecozone today is dominated by human settlement and mineral exploration. Regulations are in place to ensure that land use and development do not adversely affect heritage sites in the ecozone.

3.2 Water Use

Water is especially important to the people of the Taiga Shield Ecozone. The numerous waterbodies and watercourses provide travel corridors year round. Water is one of the primary means of transportation of goods to communities in the area.

Waterbodies also make convenient locations for dwellings and provide access to the fish and wildlife that people depend on for their livelihood. Much of the water in the ecozone is still relatively free of contamination and meets drinking water objectives, even though untreated.

A 1993 study (Buschak, 1993) rated the rivers of Saskatchewan as to their suitability for consideration as Canadian Heritage Rivers. This provincial-territorial-federal program recognizes Canada's outstanding rivers and provides a forum for the development of a plan to protect their outstanding natural, cultural and recreational values. The Grease/Straight Rivers were considered as one river system on a list of 11 determined to be the most worthy for further consideration and study as possible nominations to the Canadian Heritage Rivers System. These rivers feature a major geological fault line along which Hunt (Lefty's) Falls occurs. Several other rivers which are considered outstanding in the province and which are significant landscape features in this ecozone, but which were not included within the top group of 11, include the Chipman River, the Porcupine River, the East Porcupine River, the Striding River, the Cochrane River and the Tazin River. The headwaters of the Kazan River, a Canadian Heritage River, are located in

Barge transporting goods on Lake Athabasca. Ross Barclay

Hunt or Lafly's Falls. George Bihun

the northeast corner of the Taiga Shield Ecozone.

The Taiga Shield Ecozone is known for the scenic beauty of its waters, whether it be the clear blue lakes or the majestic Elizabeth Falls. While none of the area's rivers are particularly large, Hunt Falls on the Grease River is the highest (15 m) and, perhaps, the most scenic waterfall in the province. Located about 118 km east of Uranium City, the falls have been identified as an International Biological Program (IBP 73-10) site because of their pristine nature and rare features.

Most of the Tazin Lake watershed is included in the proposed Tazin Lake RAN site.

3.2.1 Domestic and Commercial Water Use

Compared to other ecozones, the Taiga Shield Ecozone is characterized by a generally low level of human activity and associated water use. Long, cold winters and shallow bedrock combine to make the cost of constructing and maintaining water infrastructure (i.e., buried pipelines) very expensive. Water remains an important source of food (fish) and transportation (boating and winter roads).

3.2.2 Water Use for Hydroelectric Power

With construction of the Box Gold Mine in 1937, it was decided that hydroelectricity would be favored over diesel generation to power the mine. A site on the Charlot River was chosen, and during the winter of 1938, materials were hauled over ice to allow work to begin in the spring. The new hydroelectric station, known as the Wellington Lake Power Project, would become the second hydroelectric project to operate in Saskatchewan (Island Falls is the province's oldest hydroelectric station, in operation since 1930). A dam was constructed at White Lake for the project's new 2.4 MW (megawatt) turbine. A second unit was placed in service in 1959.

By 1980, three generating stations (Waterloo, Wellington and Charlot River) provided power to communities and mines in the area. Known as the Athabasca system, whose source is Tazin Lake, these small hydroelectric stations have a combined capacity of 23 MW. Hydroelectric generation uses more than 900 billion litres/year of the region's renewable water resource.

The Waterloo, Wellington and Charlot River stations were acquired by SaskPower in 1986. They were connected to the provincial power grid through construction of a transmission line to the Island Falls Hydroelectric Station, situated on the Churchill River, just upstream of the community of Sandy Bay. Communities and commercial developments in the region now have a more reliable and economical supply of electricity. In 1999, the Athabasca hydroelectric system produced over 150 million kWh of electricity.

See Figure 6 for the electrical transmission lines and Figure 7 for the location of the hydroelectric stations in the Taiga Shield Ecozone.

Charlot River hydroelectric station. George Bihun

Waterloo hydroelectric station. SaskPower

3.3 Non-renewable Resource Use

3.3.1 Mineral Exploration and Development

The vast majority of land in the Taiga Shield Ecozone is owned by the provincial Crown and administered by SERM. Approximately 150 mineral dispositions (claims, leases and permits), comprising more than 320,000 ha, are held by companies involved in mineral exploration and development in the ecozone. The majority of the dispositions are associated with mineral exploration. Activities typically associated with mineral exploration include prospecting, line-cutting, trenching, drilling and geophysical surveys (ground and airborne).

Figure 6 **Electrical Transmission Lines Servicing the Taiga Shield Ecozone**

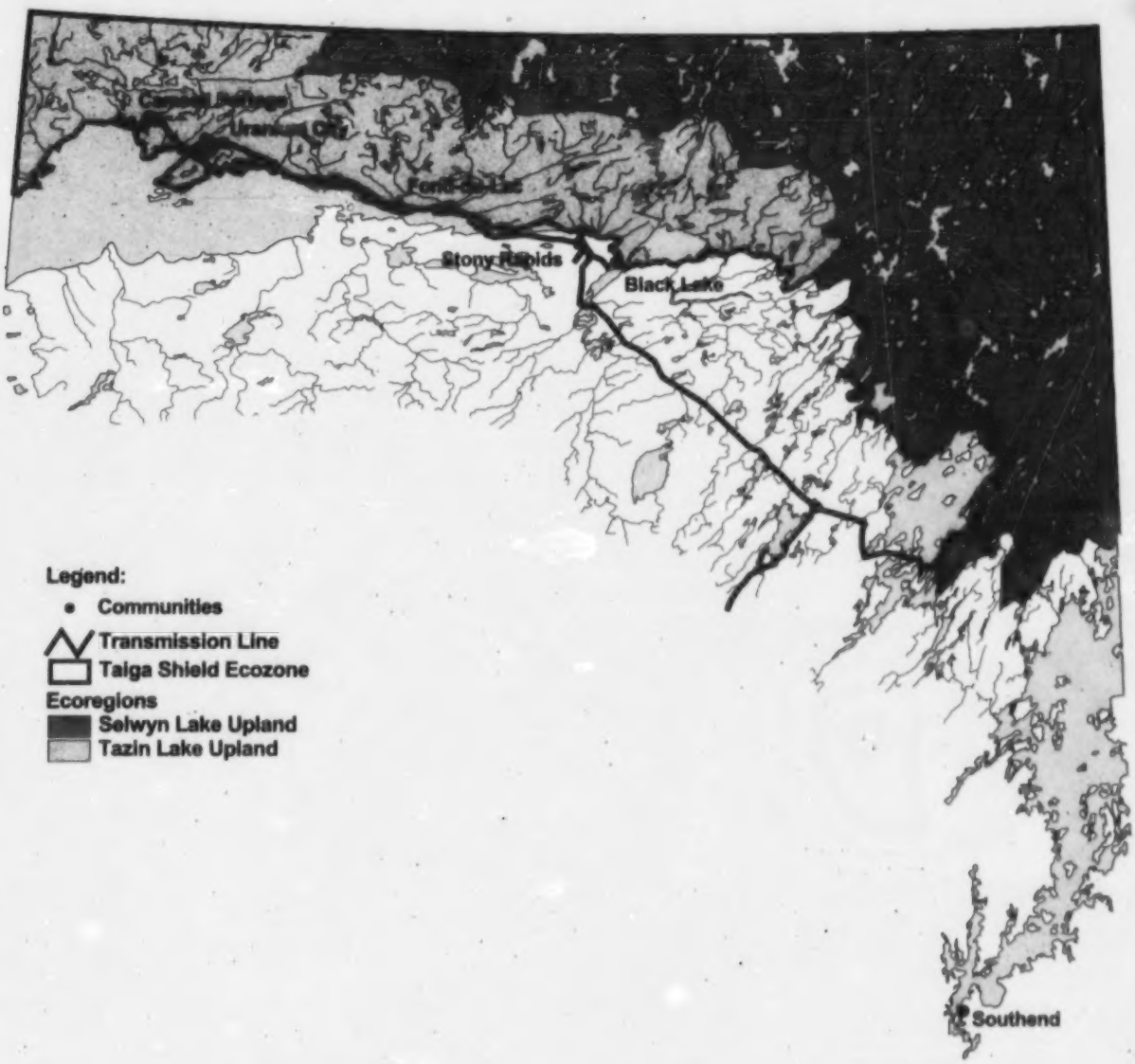
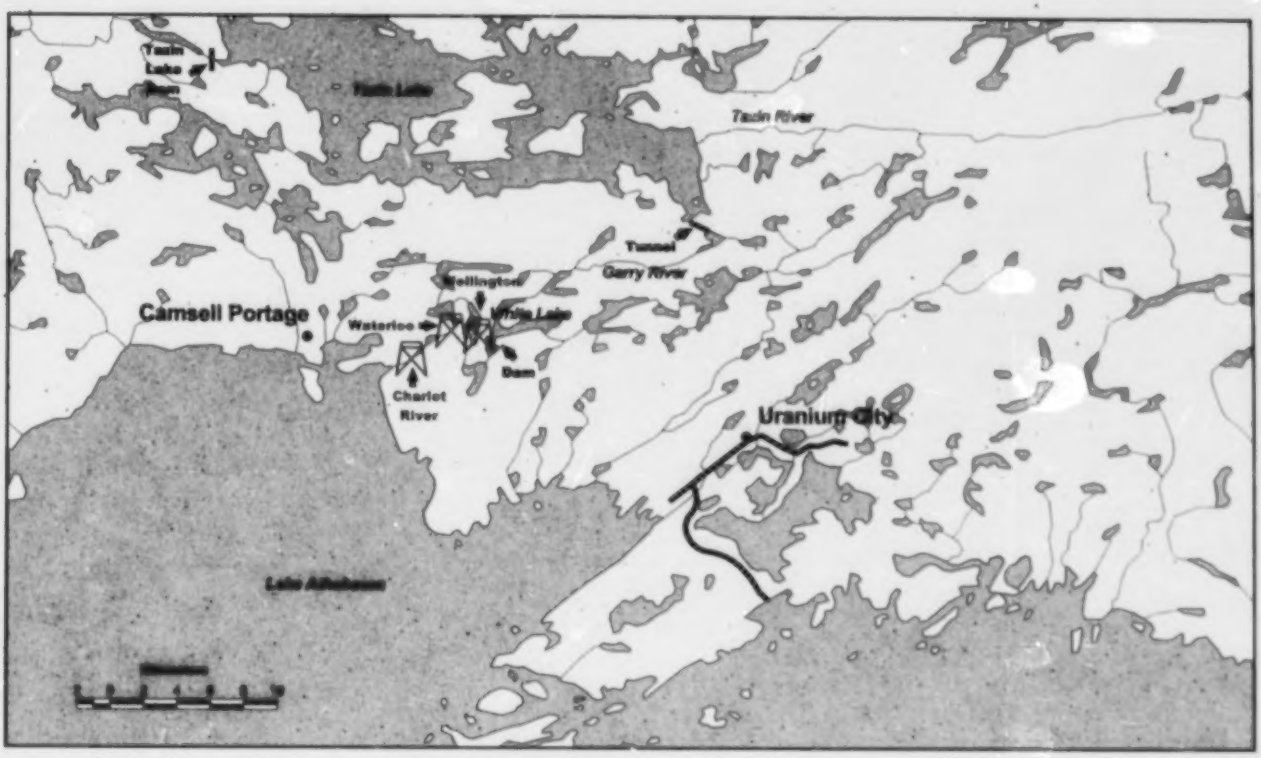
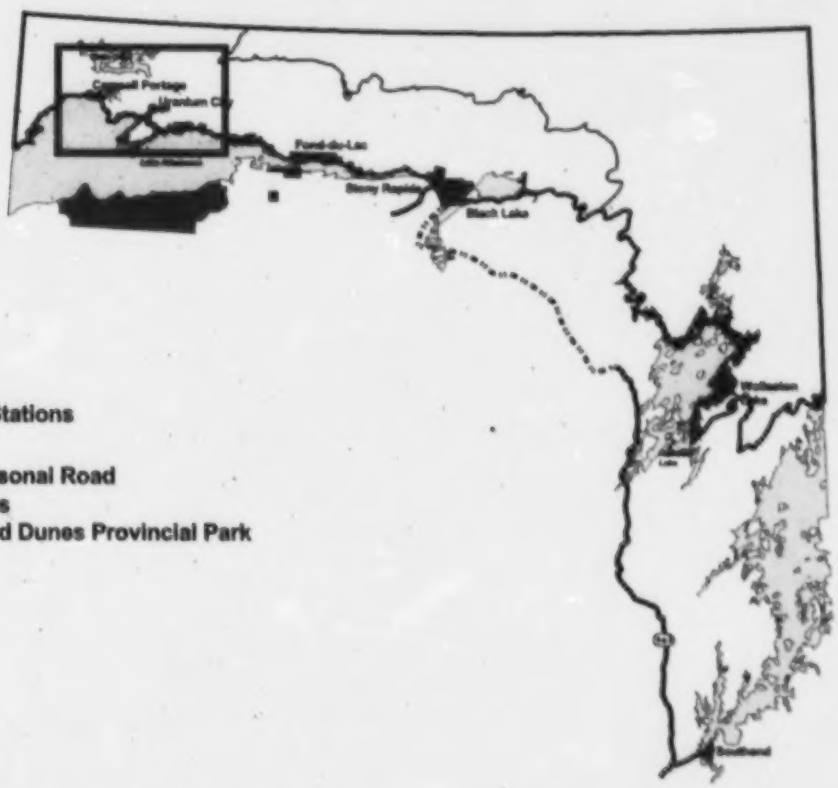


Figure 7 **Hydroelectric Stations Located in the Taiga Shield Ecozone**





Legend:
- Communities
- Hydroelectric Stations
- Highway
- Athabasca Seasonal Road
- Indian Reserves
- Athabasca Sand Dunes Provincial Park

Town of Goldfields, 1936. Saskatchewan Archives Board, Photograph #R-A11674

The first mention of the possibilities for discovery of base and precious metals in the Taiga Shield Ecozone of Saskatchewan appeared in the Annual Report of the Geological Survey of Canada, in 1895. This report recorded the findings of two reconnaissance trips. The first, in 1892, was led by Joseph Burr Tyrrell, and reached the southern limits of the Taiga Shield Ecozone along Lake Athabasca. The second, in 1893, was also led by Tyrrell. During this trip, the area north of Lake Athabasca was mapped.

The first discovery of gold in the Precambrian Shield is reported to have been made by a miner named Dalton in 1910, in the Pine Channel area located in the eastern part of the Tazin Lake Upland Ecoregion. A more significant gold discovery was made in 1934, by prospectors Tom Box and Gus Nyman, on the north shore of Lake Athabasca, between Lodge and Neiman bays. The discovery precipitated a gold rush and the establishment of the town of Goldfields in 1937, to accommodate the influx of people. By 1939, approximately 1,000 people had settled there. The Box gold mine, the first mine in Saskatchewan, began production in 1939, but shut down in 1942 because of low ore grades, shortage of labor during World War II and increasing financial problems.

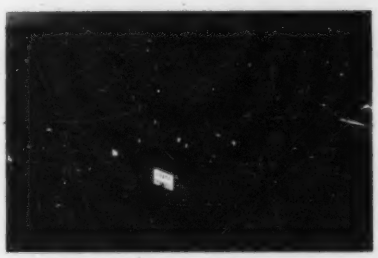
During the gold rush, prospectors identified pitchblende (uranium) 14 km southeast of the Goldfields area in 1935. Extensive exploration for uranium in Saskatchewan began in 1944 in the area north of Lake Athabasca. Philip St. Louis discovered pitchblende near Ace Lake in 1946. Production from the Ace and adjacent Fay ore bodies commenced in 1953. During the 1950s, uranium was mined from 15 deposits and milled at three separate facilities (Beaverlodge, Gunnar and Lorado) in the area. The Beaverlodge mill operated from 1953 until 1982; the Gunnar mill, from 1953 until 1964; and the Lorado mill, from 1957 until 1960. One of the 15 deposits was the Nisto ore body located about 8.5 km east of Black Lake on what is now the Chicken Reserve #226. The deposit was discovered in 1948 and in 1959 produced approximately 500 t (tonnes) of ore, which was shipped to the Lorado mill.

Aerial view of Fay shaft and mill, Eldorado Mining and Refining Co., Beaverlodge area, July 1958. Saskatchewan Archives Board, Photograph #59-322-36

The settlement of Beaverlodge became established in 1949. In 1952, the provincial government established the town of Uranium City to service the mines in the Beaverlodge uranium area. The first residences were simply tents; later, buildings were established. During the winter of 1952, almost all buildings that were capable of being moved from Goldfields were hauled to the Uranium City town site. Until 1957, the Beaverlodge area was the main source of uranium in Canada.

Other minerals of interest include silver and base and platinum group metals in the eastern part of the Tazin Lake Upland Ecoregion and rare earth elements east of the Beaverlodge area.

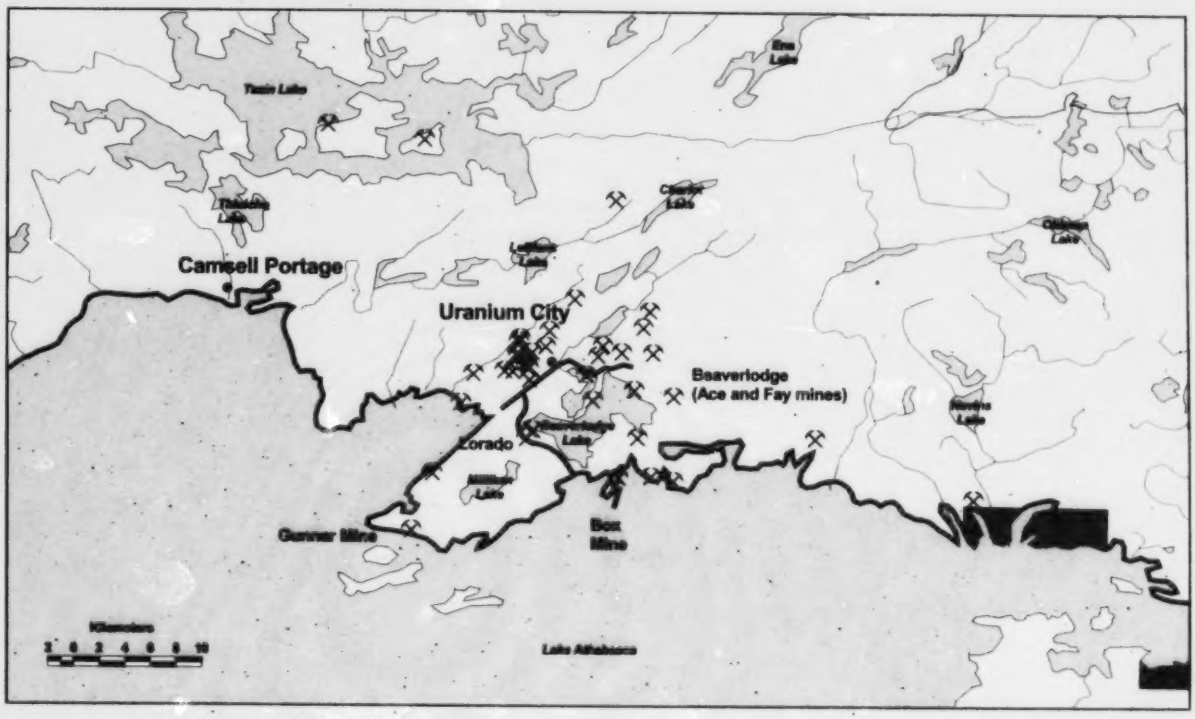
There has been no mineral production in the ecozone since 1982, when the Beaverlodge uranium mill ceased operation. See Figure 8 for these historical mining developments.



Eldorado townsite, September 1982.
George Bihun

Current low metal prices have kept mineral exploration at a minimum. When mineral exploration does occur, the activities are properly regulated to ensure that any potential impacts to the environment are minimal.

Figure 8 **Reference Map of Historic Mining Activity in the Taiga Shield Ecozone**



Legend:

- Communities
- Mines
- Highway
- Athabasca Seasonal Road
- Indian Reserves
- Athabasca Sand Dunes Provincial Park

M121

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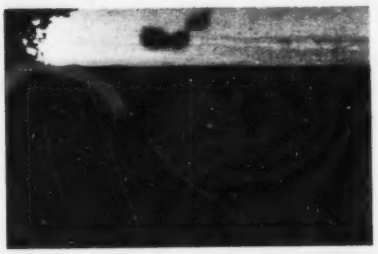
3.4 Renewable Resource Use

A subarctic climate, a preponderance of rugged topography, exposed rock and many boggy wetlands precludes virtually all agricultural or forest production endeavours.

3.4.1 Forests

The forests of the Taiga Shield Ecozone are currently impacted primarily by natural stresses. Natural stresses include widespread annual forest fires, insect and disease damage, and the long-term effects brought about by changes in the climate. Human impacts are primarily from community expansion, traditional building needs and fuel wood use.



Tazin Lake uplands. George Bihun

3.4.1.1 Forestry Development

Forest harvesting has not had a major impact on biodiversity in Saskatchewan's Taiga Shield Ecozone. There have been only a few small operations associated with construction of outfitting camps and mining developments. Recently, there has been an interest shown in the commercial use of fuel wood for heating storage buildings and hangers. While from an ecozone perspective the impact is not large, from a local perspective it is impacting the environment in the proximity of some of the communities where the harvesting is occurring. Timber harvesting, on the other hand, is not likely to become a major influence due to distance to markets and lack of affordable transportation.

3.4.1.2 Forest Fires, Insect Damage and Disease

Forest fires, the most predominant natural disturbance in the ecozone, have played a major role in shaping the environment, creating a patchwork effect on the landscape (Figure 9). Because this area is isolated, little is known about the incidence and extent of forest disease and insect damage.

See Table 3 for the number of hectares burned in the Taiga Shield Ecozone over the last 11 years.

Although forest fires, insects and diseases are viewed by many as negative forces, they are also a natural part of forest ecosystem processes and renewal. SERM is currently working on a new Fire and Forest Insect and Disease Management Policy, which reflects the ecological benefits of these forces, along with identified "values at risk." (See Section 5.7.5 for more on this).

3.4.2 Climate Change

The Taiga Shield Ecozone is an ecological crossroad, where climate, soils, plants and animals from the Boreal Shield and the Southern Arctic ecozones meet. Important considerations arising from the climate change issue in this ecozone include possible impacts on the environment, the economy and on the way people in this ecozone live, both now and in the future.

Global warming is expected to lead to higher average air temperatures and changes in the geographic distribution, temporal pattern and magnitude of precipitation. These changes, in turn, will affect terrestrial and freshwater habitats and eventually may lead to changes in the distribution, composition and abundance of living things throughout the ecozone. As greenhouse gases (GG) substantially increase in the atmosphere, potential changes may occur in the Taiga Shield Ecozone:

- increased annual mean temperatures;
- decreased flows and levels in northern flowing rivers;
- rise in lake temperatures;
- reduced ice season in streams, rivers and lakes, or a longer ice-free season;
- increased evaporation and transpiration;
- degradation of permafrost and accelerated release of methane and carbon dioxide from bogs; and/or
- increased occurrence of catastrophic weather events such as severe thunderstorms, droughts and floods.

Ecosystem impacts may include the following:

- Changes in ecosystem composition and species diversity may occur.
- A potential increase in diversity of fish species may result from increases in the diversity of thermal habitats available to support new species expanding their ranges from the south.
- An increase in forest fires, along with more insects and a longer growing season, is expected to result in noticeable changes in vegetation in the Taiga Shield Ecozone.
- Indirect effects of global warming on food and water availability will have a significant effect on wildlife and humans.
- Changes in timing and abundance of forage availability and parasite infestation may accumulate to drive fish and wildlife populations into declines.

Table 3 Number of Hectares Burned in the Taiga Shield Ecozone in Last 11 Years

Year	Hectares Burned
2000	68,000
1999	85,071
1998	120,875
1997	353
1996	5,495
1995	1,796
1994	394,704
1993	24,872
1992	20,861
1991	179,931
1990	6,510

Source: SERM

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Tazin Lake uplands. George Bihun

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Figure 9 **Forest Fire History of Northern Saskatchewan 1845-1998: Fires Greater than 1,000 ha**

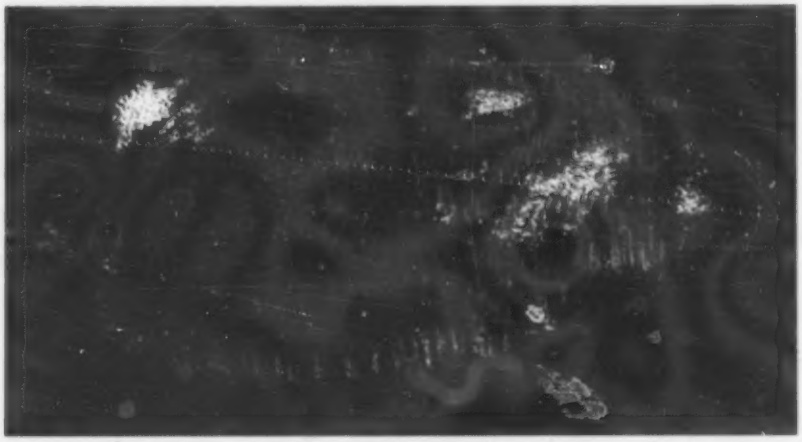
- An unstable climate could shift the balance between human activities and the integrity of ecosystems, which may affect human health.

Economic impacts may include the following:

- Northern expansion of economic activities (forestry, mining and agriculture) could result in the need for expanded air, water and land transportation.
- The boating season would be lengthened, but lower water levels would make navigation more difficult.
- Increased incidence of weak ice on lakes and rivers would lead to hazardous travel by snowmobile.
- Increased permafrost instability would likely lead to higher maintenance costs for existing all-weather roads.
- Fish populations could see an increase in sustainable harvest due to increasing ecosystem productivity, as shrinking ice cover permits greater nutrient recycling.
- Warmer temperatures are expected to benefit the recreation and tourism industries.
- Increased air temperatures will result in a longer season for summer construction activities; however, heavy construction that requires frozen ground would face a shorter season.

Scientific investigation has not, so far, determined conclusively the specific impacts of climate change on habitats and resources. Nonetheless, there needs to be economically affordable ways of adapting to climate change on the basis of what we do know.

See Appendix 6 for climate change initiatives.



Black spruce forest on a rocky island of a lake north of Wollaston Lake. Superior growth in shoreline trees is due to greater availability of water and higher nutrient status of the soils in moist but well-drained soils at the shoreline. Soils in the interior of the island are also likely to contain permafrost which produces cold soil temperatures, even in summer. Trees with their roots in cooler soils grow more slowly than trees with roots in warmer soils. Robert A. Wright

3.4.3 Fish and Wildlife

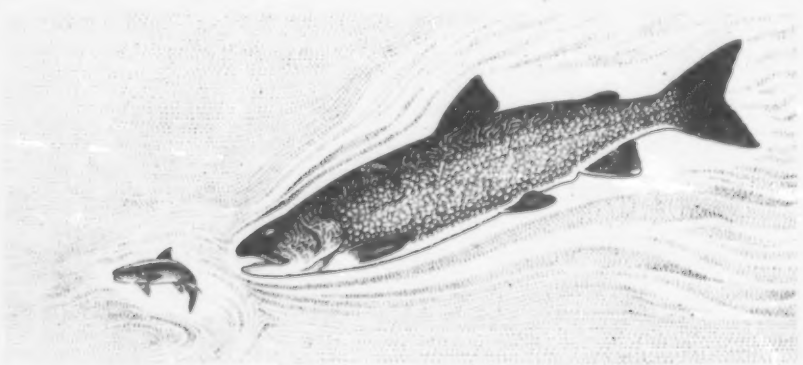
3.4.3.1 Sport Fishing and Hunting

The lakes in this ecozone have cold water and are, for the most part, oligotrophic, resulting in lower food availability within the aquatic food chain. Fish here grow much slower than the fish found in the fertile southern lakes but have a tendency to live a little longer. Because of these reasons and the relatively light fishing pressure in this area the fish are a little larger on average; however, it can take a fishery many years to recover if the resource is abused. Thirty-three lakes in this ecozone are catch and release waters.

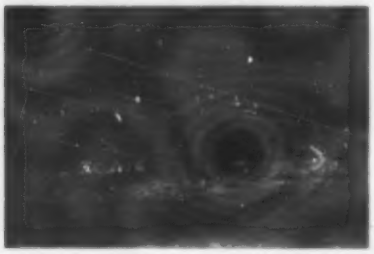
The Taiga Shield Ecozone borders two of the largest lakes within Saskatchewan, Lake Athabasca and Wollaston Lake, and the Fond du Lac and Cochrane rivers. A few of the more notable mid-size lakes are Tazin, Scott, Black, Hatchet, Phelps and Misaw. There are thousands of smaller lakes, rivers and streams offering angling opportunity. Most destinations are accessible by float plane.

Anglers are able to pursue a wide variety of game fish, including arctic grayling, lake trout, northern pike, walleye and whitefish. With the development of the new Athabasca Seaonal Road, anglers are able to access lakes during the winter and dry seasons that previously were not road accessible. Most, though, choose to fly in to remote lakes that are less heavily fished, to enjoy the remote northern environment.

Although hunting related activities in the province generate in excess of $47 million annually (Filion *et al.*, 1998), very little of this occurs in the Taiga Shield Ecozone. Hunting in this ecozone is



Lake trout chasing prey



Moose. George Bihun

primarily done by local residents for subsistence purposes, but harvest numbers are difficult to assess.

Primary species hunted by First Nations and other northern residents are moose and barren-ground caribou. Barren-ground caribou, when they migrate into the province from the NWT and Nunavut, may only be hunted by residents of northern Saskatchewan. Harvest numbers vary from year to year, depending on the extent of the migration.

A limited number of licenced hunters pursue black bears in this ecozone. They are primarily non-residents of Canada who use the services of a registered outfitter in the area.

Increased use of the Athabasca Seasonal Road, linking this ecozone to the south, will bring many challenges, and opportunities, to the people of the Athabasca. Many residents have expressed fears that this growing access will negatively impact the fish and wildlife of the region. Road and access by trail, for whatever purpose, brings with it many challenges to resource management. Lakes and hunting grounds that were once difficult to access will now be in easy reach of not only local people, but residents from elsewhere. Specific concerns include increased use by licenced hunters and fishers, potential use by more southerly Aboriginal people exercising Treaty rights, illegal hunting and fishing, and increased industrial development, resulting in hazardous spills and other environmental problems. Balancing these concerns is the realization that new access will also make harvesting fish and wildlife easier and more cost-effective for local users. These issues will be considered during the land use planning process for the Athabasca Basin. Possible mitigative measures that may be taken include implementation of fish and game road corridor preserves, conservation restrictions on some waterbodies, prompt closing and reclamation of exploration trails and the co-management of resources.

3.4.3.2 Outfitting

There are 25 licensed angling outfitters in the Taiga Shield Ecozone, who provide guiding services and/or equipment to their clientele. Clients are usually flown in by float plane to base camps, out camps and day-use facilities on approximately 120 lakes in this ecozone. Figure 10 shows the waterbodies where fish outfitting occurs. Visitors to these camps are usually attracted by large northern pike and lake trout, but arctic grayling and walleye (which are not found in large numbers in this ecozone) are also sought.

3.4.3.3 Commercial Trapping

First Nations and Métis people dominate commercial trapping activity. Over time, trapping has become an extension of the remote outdoor lifestyle that typifies the Dene and Métis cultures of the ecozone. A variety of fur-bearing species are trapped, but as the trapped species are usually in low numbers in the Taiga Shield Ecozone, trapping provides only an economic supplement for many families. Trapping pressure in this ecozone has little long-term effect on animal populations.

3.4.3.4 Subsistence Hunting/Fishing/ Trapping/Gathering

The predominately Aboriginal population of this ecozone hunt, fish, trap and gather products of the forest for food, clothing and medicine. These traditional activities are part of a way of life that is dependent on a healthy state of the environment.

3.4.3.5 Enforcement and Compliance

The main issues of renewable resource enforcement and compliance in the Taiga Shield Ecozone are the abuse of fish habitat, over-fishing and caribou hunting. Increases in the local population, changing lifestyles and road access into the area have the potential to put greater demands on caribou populations. Increased access leads to increased hunting, which may lead to increased trafficking and wastage.

The commercial fishery in the Taiga Shield Ecozone has been almost non-existent for years due to the high freight costs and low fish prices. Commercial fish harvest limits are determined for individual lakes based on their size, amount of use and biological productivity. The commercial fishing industry is closely monitored to ensure compliance with regulations. Annual total weight limits are set with appropriate percentages of species, season dates and net mesh size. Records of commercial catches are required to ensure compliance to these limits.

There is no record kept of the amount of subsistence catch by northern people. The communities are growing, which puts increasing pressure on the resources; however, impacts are not monitored at this time.

Arctic grayling catching a meal

Outfitting has increased over the years, with more lakes being accessed. SERM does not collect fish catch records from outfitters, so the amount of pressure they are putting on the fish resource is unknown. Most outfitters practice catch and release, but there is still a mortality factor.

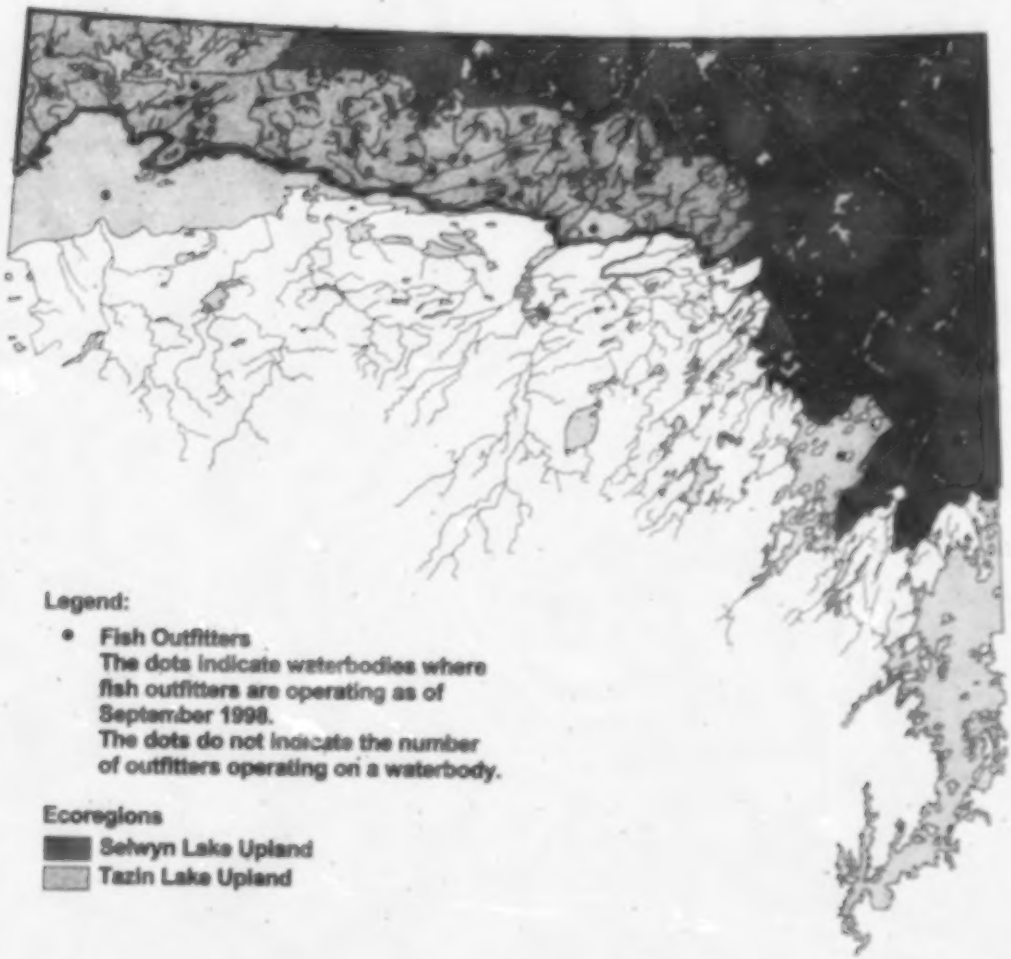
It is possible for even these remote fish stocks to be harmed, as happened in two cases in the Uranium City area. A grayling population was wiped out of Martin Lake by a combination of fishing pressure and habitat destruction, and a large-trout population in Tazin Lake was decimated by trophy anglers in the 1970s. The large fish are just starting to return.

The Taiga Shield Ecozone was very isolated until recently. This isolation, combined with a small local population, has minimized the amount of human pressure on the environment and, in particular, barren-ground caribou. With high local birthrates and increased access to the area with the opening of the Athabasca Seasonal Road during the winter of 1999-2000, there may be an increase in hunting pressure. Monitoring of this activity in such a large area is difficult. Presently, caribou populations appear to be high and can absorb the increased pressure, which is not only occurring in Saskatchewan but all over their range. Uncertainties resulting from climate change and other potentially detrimental changes will require that local residents and regulators be alert and conservative when managing future caribou populations. This resource is shared by four jurisdictions.

3.4.4 Ecotourism and Recreation

Ecotourism, which is growing dramatically in other areas of Saskatchewan, has not taken on the same relevance in the Taiga Shield Ecozone. Areas such as the Fond du Lac River, Elizabeth Falls and the mountainous terrain of the north shore of Lake Athabasca draw the attention

Figure 10 **Waterbodies with Fish Outfitting Operations in the Taiga Shield Ecozone**


Legend:
Fish Outfitters
The dots indicate waterbodies where fish outfitters are operating as of September 1998.
The dots do not indicate the number of outfitters operating on a waterbody.
Ecoregions
Selwyn Lake Upland
Tazin Lake Upland

Tazin Lake uplands at Lake Athabasca, Reed Bay fault. George Bihun

of visiting tourists, but they are usually secondary activities associated with the sports fishery.

Some existing outfitters are offering ecotours as part of their fishing experience to meet the growing demand. Ecotourism in this ecozone faces global competition and marketing challenges. Distance from markets, lack of adequate food and accommodation services, and the cost of air travel are key challenges.

This is an isolated ecozone, mostly dependent on air travel. The community-based landing strips are staging areas for people who want to visit the Athabasca Sand Dunes Provincial Wilderness Park in the Boreal Shield Ecozone.

There are no parks in this ecozone. There are only a few canoeists, campers and sightseers, and the numbers are not monitored.

3.5 Economic Significance of Resource Use

Little economic data exists specifically for the Taiga Shield Ecozone. Some data are available for the province and the Northern Administrative District (NAD) of which the Taiga Shield Ecozone is a part. Economic data for the NAD is skewed by the relatively higher population of the southern part of this administrative district. Statistics that are an amalgam of the communities of the NAD do not accurately represent the economic makeup or situation in the Taiga Shield Ecozone. As a result, data for most of the industrial sectors typically represented by national and provincial accounting offices are unavailable for the communities of this ecozone.

The ecozone's geographic location makes the provision of infrastructure a difficult and costly task. Transportation to and from the area is primarily by plane and by barge on Lake Athabasca. Barge service is available from June to October only. This makes the movement of goods to market an expensive proposition and greatly increases the cost for even basic materials and supplies. In addition, the great distance from primary markets in the south makes transportation of goods and services difficult to deliver on time. Distance from southern markets also contributes to a significantly higher cost of living for northern residents and results in the need for higher wages. This, in turn, results in higher start-up and operating costs for businesses. Although the Athabasca Seasonal Road, a winter road, was completed in late 1999, linking the communities of Black Lake and Stony Rapids to Points North Landing and to the south, both communities lie outside the southern border of the Taiga Shield Ecoregion. There is also a winter road open for short durations linking Uranium City and Fond-du-Lac.

The Taiga Shield Ecozone has a short growing season and lower mean temperature than any other part of the province. These limitations virtually eliminate agricultural and forest production at provincial, national and global norms. In addition, parts of the ecozone are characterized by discontinuous permafrost, complicating construction and development activities.

The low population density of the villages of the ecozone makes the provision of some services uneconomical, and economic opportunities that would benefit from collaborative efforts are difficult to attain.

3.5.1 Non-renewable Resources

Although both gold and uranium have been produced in the Taiga Shield Ecozone in the past, there has been no mineral production in the ecozone since 1982, when the Beaverlodge uranium mill ceased operation. However, residents of local communities (Uranium City, Fond-du-Lac, Camsell Portage and Wollaston Lake) in the Taiga Shield Ecozone are employed at fly-in/fly-out mining operations located in the adjacent Boreal Shield Ecozone.

There is mineral potential in the ecozone and exploration is conducted on an ongoing basis. The majority of the mineral exploration in Saskatchewan is conducted in the northern part of the province, although only a small portion is conducted within the Taiga Shield

Forms of transportation. George Bihun

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Ecozone. Mineral exploration is an important source of employment and creates business opportunities for northern residents. An estimated 20 to 40 jobs are created for every one million dollars spent on mineral exploration. See Table 4 for mineral exploration expenditures.

Table 4 Grassroots Mineral Exploration Expenditures in Saskatchewan

	1994	1995	1996	1997	1998	1999
	(millions of dollars)					
Precious Metals	4	8	7	4	3	2
Base Metals	4	4	5	10	4	6
Uranium	11	13	17	27	22	14
Other	10	4	6	2	1	1
Total	29	29	35	43	30	23

Source: SEM

3.5.2 Forest Fire Suppression

Fire suppression is an important source of income for northerners. Aside from direct employment as fire fighters, money is funneled through local businesses and suppliers, heavy equipment operators and aircraft companies, who provide support for the fire management efforts. See Figure 11 for locations of fire management personnel field locations in the two forest protection areas that include the Taiga Shield Ecozone.

Annually, approximately $45 million (10-year average) is spent to support fire suppression efforts in the province. Employment created includes 89 permanent seasonal fire management positions, 743 seasonal and contract positions and as many as 10,000 short-term emergency fire fighter positions in severe fire seasons, such as in 1995 and 1998. The amount spent in any one year is affected by many factors, including the number of fires that occur, the location of fires, the fire growth potential and area burned, the values threatened and the resources required to manage these fires.

Water bomber dropping its payload in the forest. These aircraft carry thousands of litres at a time and are an important factor in the strategic control of wildfires. SERM

3.5.3 Commercial Use of Renewable Resources

3.5.3.1 Forestry

Forestry in the Taiga Shield Ecozone is currently held to be uneconomical, due to low yields per hectare and slow reforestation rates. There is, at present, no commercial forest harvesting. Additionally, the slow growth rates in the far north make replanting and recovery rates for disturbed areas slow, and in some cases disturbances are irreversible.

3.5.3.2 Commercial Fishing

Taiga Shield Ecozone residents have fished commercially since at least the 1930s. The principal species originally taken were whitefish and lake trout (Table 5). This trend has changed to target species such as pike and walleye (pickerel). Of the thousands of lakes in the Taiga Shield Ecozone, only a handful support active commercial fisheries, and most are located on the eastern side of the province within proximity to Highway 905 and the Wollaston fish plant. The most important commercial fishery, and one of the premier ones in the province, is Wollaston Lake, located immediately to the south of the Taiga Shield Ecozone, with a summer quota of 205,000 kg whitefish, 8,000 kg walleye, 17,000 kg pike and 135,000 kg lake trout.

Walleye

Many of the other lakes that have commercial harvest allocations are too remote to be fished economically. In the 1980s, the closing of the fish plant on Lake Athabasca and the elimination of the transportation subsidies, coupled with the rising cost of living and the low fish prices, made it uneconomical for many residents to fish commercially. The Lake Athabasca commercial fishery ceased to exist shortly after the closing of the Lake Athabasca fish packing plant at Gunnar.

Table 5 1996-97 Commercial Fish Harvest in the Taiga Shield Ecozone

Species	Kilograms	Percentage
Whitefish	113,326	53.1%
Lake Trout	86,151	40.4%
Walleye	9,565	4.5%
Northern Pike	4,238	2.0%
Total	213,280	100.0%

Source: SERM

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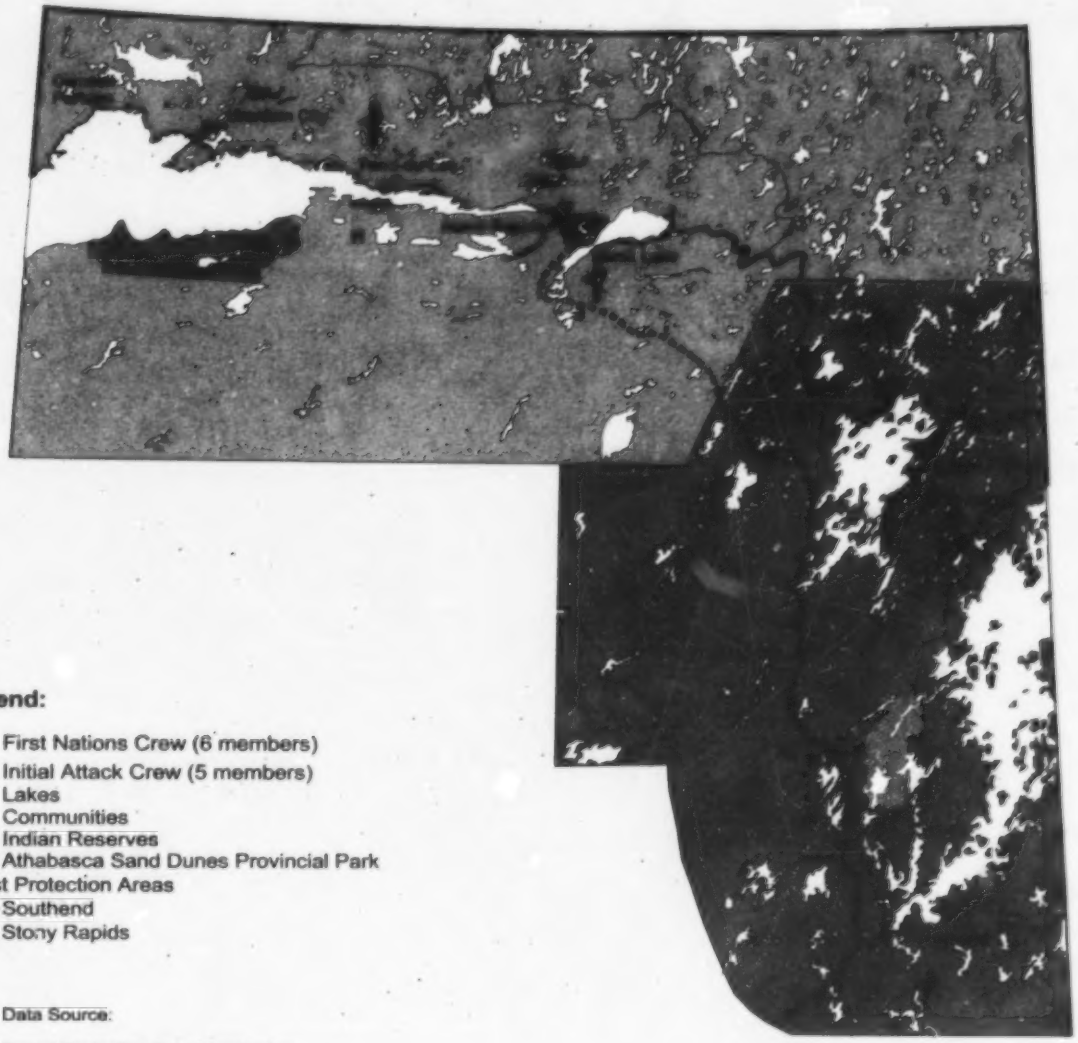
Figure 11 **Fire Management Personnel Field Locations for the Taiga Shield Ecozone**



Legend:

- First Nations Crew (6 members)
- Initial Attack Crew (5 members)
- Lakes
- Communities
- Indian Reserves
- Athabasca Sand Dunes Provincial Park

Forest Protection Areas

- Southend
- Stony Rapids

Data Source:

Forest Protection Area Boundaries
Initial Attack Bases
- FMFP/SERM, 1999

Field Locations
- FMFP/SERM, 2000

Ecozones & Ecoregions
- Agriculture Canada (CANSIS), 1996

Base Data
- SaskGeomatics

There has been a renewed interest in reopening commercial fishing on Black Lake as the new Athabasca Seasonal Road may allow economical transport of the fish to market. Black Lake had been reserved as a traditional domestic fishery in past years, closed to commercial fishing based on the wishes of the Black Lake residents. However, with the current lack of economic opportunities the residents have chosen to explore the possibility of re-initiating the commercial fishery.

Commercially fished lakes include the following (** those fished in the past three years*): Anderson, Bannock, Burnet, Carlson, Charcoal*, Daschuck, Deering, Graham*, Gustafson, Hatchet*, Heinz, Hooker, Hull, Hydichuck, Kikeewapiw*, Kingsley*, Kingston*, Laback*, Larson*, Lay*, Melnick, Oback, Obst, Ooms, Pennycock, Sava, Scrimes, Tatlow*, Wagner*, Waspison*, and Wollaston*.

Commercial fishing in all of Saskatchewan is a $4.5 million industry supporting more than 4,000 direct and indirect jobs.

3.5.3.3 Commercial Trapping

In Saskatchewan, trapping represents a $1.64 million annual (1989/90-1998/99) industry. This sector has declined considerably in the last two decades, mainly due to declining fur prices as a consequence of declining European and Asian markets, following the anti-trapping and fur movements in the 1980s (Figure 12). This resulted in a decline in number of active trappers and subsequent fur production (Figure 13).

Mean annual (1994/95-1998/99) cash value of pelts for the Taïga Shield Ecozone represents 3.9% of the Northern Fur Conservation Area (NFCA) and 1.7% of the provincial value of pelts (Table 6). Mean annual (1994/95-1998/99) pelt production for the Taiga Shield Ecozone represents 1.8% of the NFCA and 0.8% of the provincial pelt production (Table 6).

A 1991 StatsCan Census report placed the total number of part-time and full-time employees in the fishing, trapping and hunting industry in Saskatchewan at 165 persons, 140 of whom were in the north. These numbers are spread over the three industries, which suggests that the numbers for the trapping industry are much lower. The number of licenses sold for the NFCA, which includes the Boreal and Taiga Shield ecozones, for 1998/99 were 1,878. These numbers do not represent the significance of trapping to the subsistence lifestyles of northern residents.

3.5.3.4 Outfitting

The outfitting industry in Saskatchewan generates $40 to $50 million in direct revenues and $90 to $100 million in economic activity for local communities. Revenue estimates for outfitting operations associated with the 16 lodges in the Taiga Shield region range from $500,000 to $5 million annually. Revenues by lodges in the area are derived primarily from sport fishing operations.

3.5.4 Recreation-related Activities

Tourism is one of Saskatchewan's main economic activities. Tourism from wildlife hunting and viewing in Saskatchewan produces revenues in excess of $140 million annually. Annual government revenues for resident and non-resident angling are $3.1 million and for hunting, $6.5 million, for a total of $9.6 million.

The Taiga Shield Ecozone contains abundant recreational resources in the form of lakes and rivers suitable for fishing, canoe tripping and other outdoor activities. However, this ecozone is far from the populated areas of the western provinces and states, and this distance, combined with the absence of paved roads, has limited the appeal of this area to potential visitors.

No parks currently exist in the Taiga Shield Ecozone, although three large sites are being considered for designation as part of the RAN program being undertaken by SERM.

Table 6 Comparison of Annual Pelt Production and Pelt Value, 1994/95-1998/99

	Total Pelt Production			Total Pelt Value ($)		
Year	Province	Northern Fur Conservation Block	Taiga Shield*	Province	Northern Fur Conservation Block	Taiga Shield*
1994/95	**134,469**	**55,793**	**1,598**	**1,926,981**	**910,474**	**40,326**
1995/96	**135,474**	**69,655**	**959**	**1,947,950**	**874,881**	**27,800**
1996/97	**203,403**	**82,191**	**1,185**	**2,990,892**	**1,219,593**	**47,194**
1997/98	**189,014**	**91,660**	**1,298**	**2,020,259**	**984,739**	**36,595**
1998/99	**82,273**	**41,392**	**1,008**	**1,100,563**	**520,848**	**21,967**
Mean	**148,927**	**68,138**	**1,210**	**1,997,329**	**902,107**	**34,776**

Footnote: Taiga Shield is represented by 3 fur blocks (N-23, N-24, N-50, N-93 and north half of N-68).

Source: SERM

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Source: SERM

Figure 12 **Annual Pelt Value for Saskatchewan, 1970/71-1998/99**

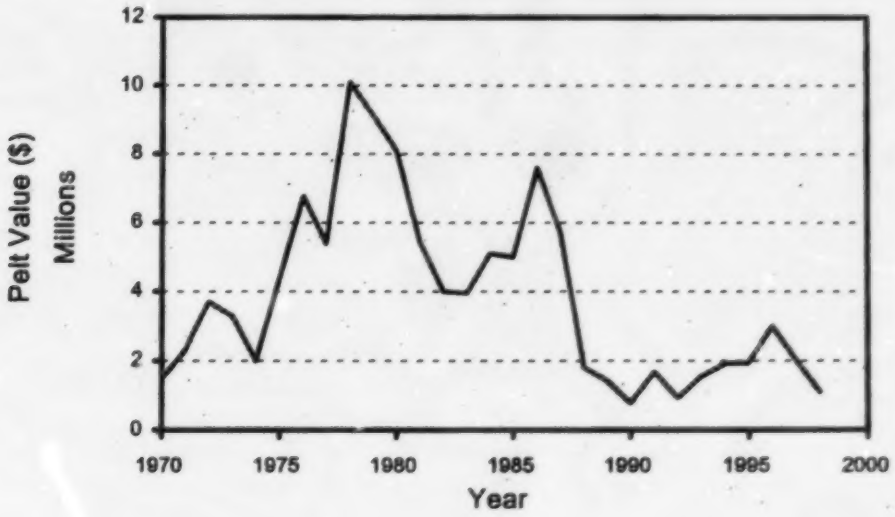
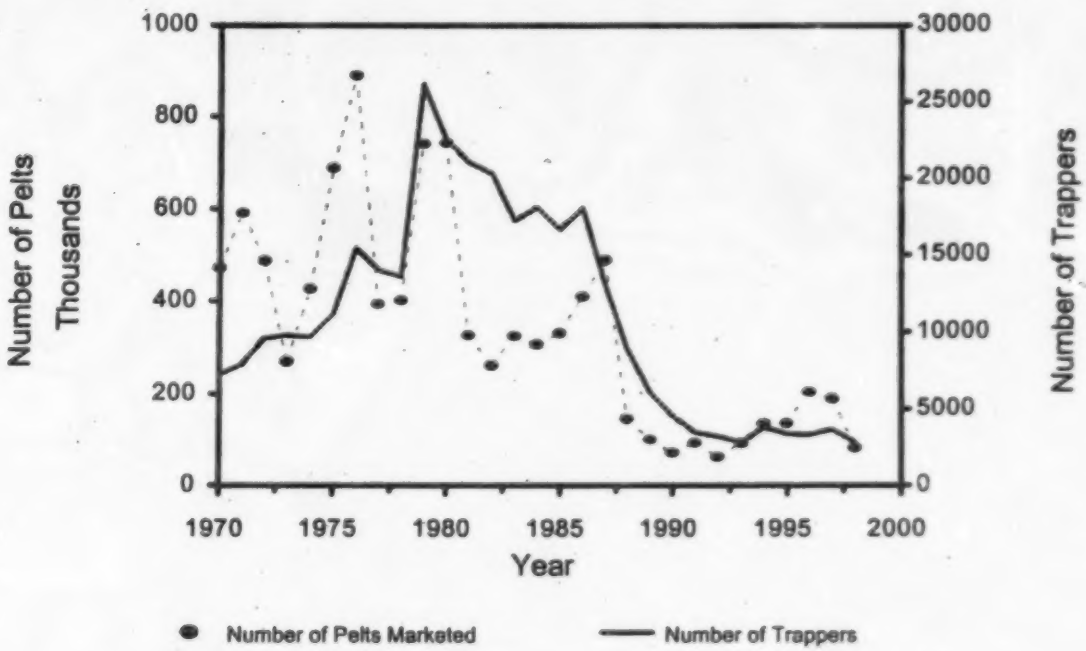
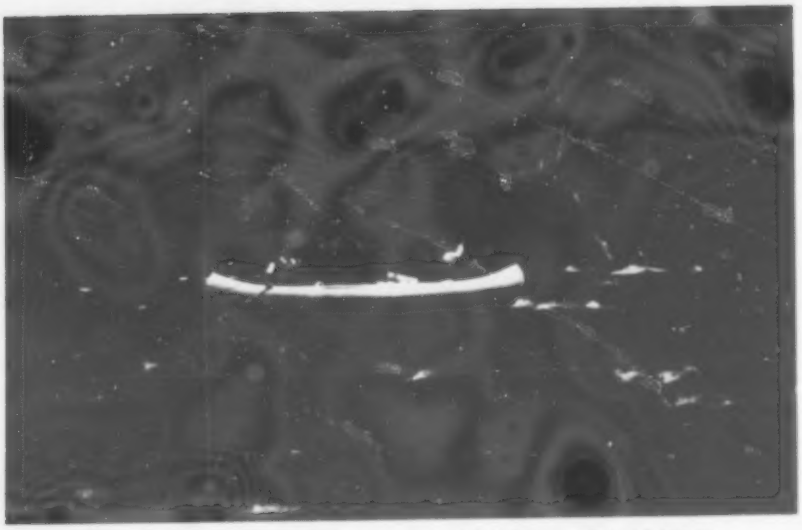


Figure 13 **Annual Pelt Production and Number of Trappers in Saskatchewan, 1970/71-1998/99**





Whitewater canoeing on the clear, cold waters of the Taiga Shield Ecozone. Robert A. Wright

3.5.4.1 Ecotourism

There are outfitters, both within and outside the Taiga Shield Ecozone, who offer ecotours in the ecozone, but none are yet accredited under the new ecotourism accreditation system of the Ecotourism Society of Saskatchewan (ESS). Most outfitters in this ecozone concentrate on providing angling opportunities, but some do offer ecotourism side trips, such as canoeing, bird watching and hiking.

3.5.4.2 Sport Fishing

The Taiga Shield Ecozone contains hundreds of lakes and rivers that provide many kinds of fishing opportunities. The rock-encased Shield lakes offer fly-in fishing, limited drive-in fishing, and back country lakes and rivers for sport fishing opportunities.

The *1995 Survey of Sport Fishing in Saskatchewan* tracks data by zones, but not by ecozones. The northern zone includes most of the Taiga Shield Ecozone, as well as the Boreal Shield Ecozone. The northern zone accounted for 86,885 angler-days of activity. When multiplied by $49 (the average amount spent per angler per day) you get a total of $4.26 million spent in the northern zone alone on sport fishing, and this does not include indirect or induced expenditures that have many beneficial spinoffs associated with them. With the lack of road accessability, the vast majority of anglers using this fishery are flown in. Establishment of outfitting businesses, use of northern air services, and related tourist businesses such as restaurants, hotels and campgrounds, all benefit significantly from expenditures made by anglers.

Sport fishing is a major recreational activity in Saskatchewan as a whole. The *1995 Survey of Sport Fishing in Saskatchewan* estimates that anglers spend approximately $26 million directly on fishing-related expenses in this area of the province each year, including food and lodging costs, outfitting packages, transportation, and related fishing services and supplies. It also estimates 2.2 million angler-days of activity resulted from fishing activity in 1995 in Saskatchewan (this includes resident and non-resident anglers). Only 86,885 of these angler-days were spent in the northern zone, and likely only about one-quarter of this was in the Taiga Shield Ecozone.

3.5.4.3 Sport Hunting

Provincial statistics on hunting activity are reported by Wildlife Management Zone (WMZ), and gathered by licence sales and voluntary reporting by hunters. The Taiga Shield Ecozone is fully within WMZ 76, as is part of the Boreal Shield Ecozone. The real economic impact of hunting in the Taiga Shield Ecozone is unknown, since statistics are skewed by their aggregation with the Boreal Shield Ecozone. Also, Aboriginal people subsistence hunt and are

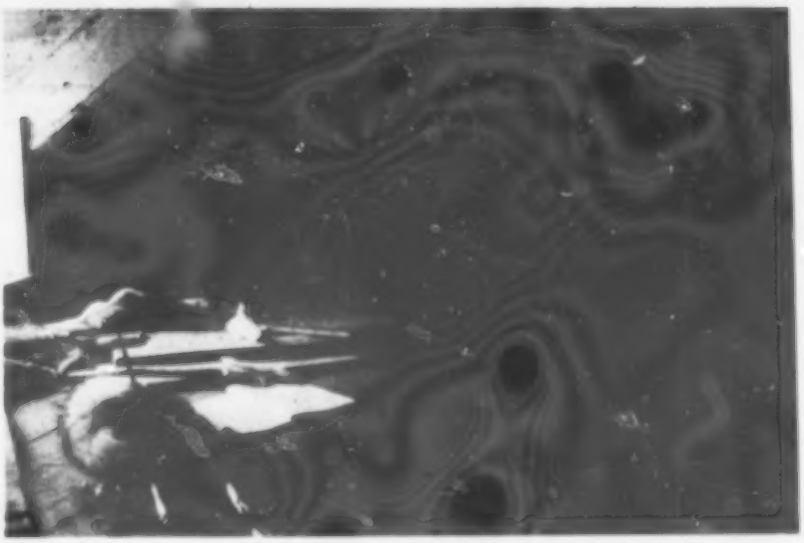
Tazin River. George Bihun

not required to attain a licence. They may hunt all year without restrictions to limits, except where conservation is a concern.

For various reasons, there are very few hunting statistics available or gathered for this area. The big game species that inhabit the area are moose, black bear and barren-ground caribou. Hunting of barren-ground caribou is restricted to residents of WMZ 76, to prevent over-hunting of a mainstay of their diet. The remaining big game species are relatively sparse and can be found in areas further to the south, where weather conditions during the fall hunting season are more favorable and where there is road access. Considerable hunting for black bear also takes place in this ecozone, but no data is maintained for the game management zone, and therefore, no estimate of hunter-days for black bear is available. Because there are no waterfowl staging areas in this ecozone, waterfowl hunting is mostly of an opportunistic nature by subsistance hunters.

3.5.5 Subsistence Hunting/Fishing/ Trapping/Gathering

Subsistence use of the resources of the Taiga Shield Ecozone by its residents, and the residents of communities adjacent to its southern limits, are judged to be higher than in most northern communities south of the Taiga Shield Ecozone. Although many residents of the Taiga Shield Ecozone find employment in local governments, First Nations governments, public services, and in uranium mining operations to the south, nearly all indigenous residents are forced to supplement whatever incomes they obtain by subsistence activities. More than 90% of the residents of the area are of Aboriginal ancestry, and most employ skills handed down though generations of hunting, fishing and trapping to augment household food supplies. Non-Aboriginal residents, who generally are employed in education and health services and receive incomes significantly higher than other residents of the region, also rely, to a lesser extent, on subsistence use of resources to subsidize the high cost and poor quality of imported domestic foodstuffs.



Trapping is an ancient traditional practice in the Taiga Shield Ecozone and is ecologically sustainable if wisely managed. Robert A. Wright

Although studies have been undertaken of northern communities south of the Churchill River to determine the level and economic significance of subsistence resource use, none have been conducted in the Taiga Shield Ecozone, or in its adjacent communities. A bush harvest study conducted at the village of Pinehouse Lake in the Boreal Shield Ecozone attempted to determine the food weight value for moose, black bear, woodland caribou, white-tailed deer, snowshoe hare, grouse, ptarmigan, waterfowl, lynx, muskrat, beaver, fish and berries (Tobias, 1988). The Pinehouse Lake study suggests that an average of 0.3 kg of meat was available per day for every member of the community. The value of "bush commodities" and "income-in-kind" were estimated to represent 35% of the annual gross income of the village. Gross annual income included the gross wages paid to non-residents by non-resident employers in the village and transfer payments made to residents.

It is important to note that the Pinehouse Lake study was conducted in an area far removed from the Taiga Shield, in a markedly different environment. Communities in the Taiga Shield Ecozone, until late 1999, have been, for most purposes, isolated from the social, cultural and economic life of the province, and even from other northern regions. Basic commodities and foodstuffs have been brought in by barge and by air, resulting in costs approaching double those in more southerly communities. It is likely, therefore, that subsistence use of the Taiga Shield Ecozone's resources forms an even more significant proportion of the region's economy than in the community of Pinehouse in 1988. If the Pinehouse study can be used as a model for other northern communities, then subsistence use of natural resources in the Taiga Shield Ecozone may represent a significant non-economic activity. Additionally, small communities in all parts of Canada enjoy an "unofficial economy" through the barter system. Although they are likely very substantial, the level and benefits of these activities are not monitored and are unknown to government agencies.

M121

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DENE-CARIBOU RELATIONSHIP

There is a group of Dene known as the "etthén-eldeli-dene" (caribou eaters) who hunted barren-ground caribou from the Beverly and Qamanirjuaq herds. These nomadic people were very attuned to the life patterns of the caribou and travelled across the subarctic forests and tundra intercepting the migrating herds along migration corridors and water crossings. They were dependent on the caribou for most of the basic necessities of life. Although other foods were sometimes available when caribou were not, caribou provided much of the materials needed for shelter and clothing. For example, bones could be used to make needles and utensils, antlers could be made into tools, and sinew into thread; the fat provided fuel and light; and the hide could be used for clothing and tent material. A tent might consist of a framework of poles bound together at the top and covered with as many as 70 caribou skins.

Their nomadic lifestyle ended in the 1940s and 1950s when the Dene began living in permanent settlements. These communities were strategically located on a major caribou migration route. This way, caribou could be harvested during both the spring and fall migrations when animals moved back and forth between their winter range and calving grounds. These two harvests provided a year-round supply of food. The caribou, however, did not always migrate to the same wintering grounds so did not always pass within the hunting range of these communities. When the caribou were not accessible to the Dene, much hardship and starvation resulted.

The availability of modern communications, aircraft and snow machines have helped to make the caribou more accessible to Dene from northern Saskatchewan. ❑

3.6 Northern Settlements

Most residents of the Taiga Shield Ecozone are of Aboriginal descent. For the Lac La Hache, Fond du Lac and Chicken reserves, the major employment is in service or support industries. The largest employing industry outside of services is the mining industry in the Boreal Shield Ecozone.

Many residents of the Taiga and Boreal Shield ecozones continue to live an active lifestyle that depends on widespread access to fish, game and other resources, including the herds of barren-ground caribou wintering in the northern part of the Taiga Shield Ecozone.

The four northern municipal communities situated in the Athabasca area are the Northern Hamlet of Stony Rapids and the Northern Settlements of Uranium City, Wollaston Lake and Camsell Portage. Although Stony Rapids is in the Boreal Shield Ecozone, it has close ties to the other communities.

3.6.1 The Northern Hamlet of Stony Rapids

The Northern Hamlet of Stony Rapids is situated along the southern shore of the Fond du Lac River at the western edge of Indian Reserve #224 of the Black Lake First Nation. This community is located in the Athabasca Plain Ecoregion of the Boreal Shield Ecozone. The first Metis people to live in Stony Rapids may have arrived in the area in the 1920s. During the 1940s and 1950s, this community began developing into a regional administrative and service centre. In 1947, the Saskatchewan provincial government began operating regional offices in Stony Rapids and the community's first school was opened. (Another major service centre in the Basin would have been Uranium City during the 1950s to the early 1980s.) Today, services and businesses currently include an airport, nursing station, school (kindergarten to Grade 9), a motel, RCMP, construction companies, retail stores and provincial government offices, such as SERM and Saskatchewan Highways and Transportation. The present population of Stony Rapids consists of several individuals of Dene, Cree, Metis and European ancestry. Many Dene residents have recently regained their Treaty status through Bill C-31.

3.6.2 The Northern Settlement of Wollaston Lake

The Northern Settlement of Wollaston Lake sits adjacent to the reserve community of the Hatchet Lake First Nation. The first permanent residents of the Wollaston Lake communities arrived after a government store and fish plant were established at the site of the present-day community in the 1950s. The majority of the residents of the settlement are of a Dene ancestry, but a few are of a Cree background. During the 1950s, a number

Barren-ground caribou winter trails. Tim Trottier

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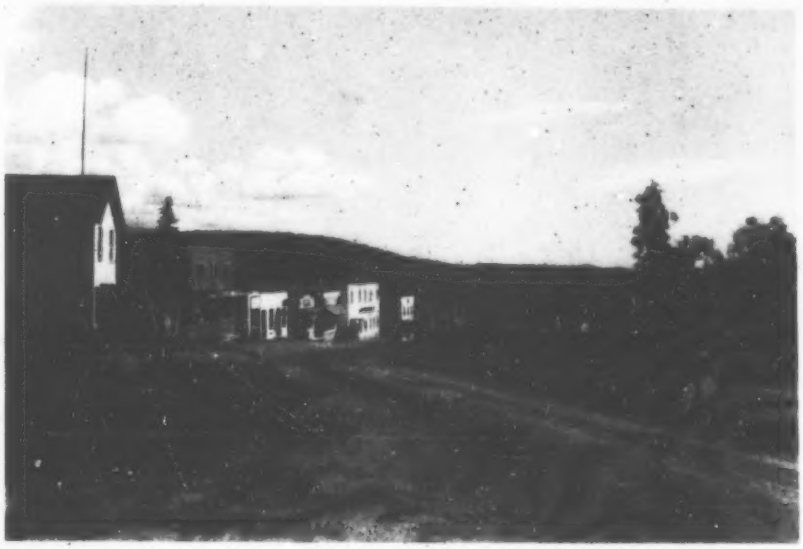
Barren-ground caribou winter trails. Tim Trottier

of individuals of a Cree-Métis background moved to Wollaston Lake from the Northern Community of Snake Lake (more commonly known today as Pinehouse Lake).

3.6.3 The Northern Settlement of Uranium City

Uranium City was established by the Saskatchewan government in the early 1950s, for the purpose of providing a service centre for uranium mines found in the Beaverlodge area. Uranium City is situated to the west of Martin Lake, just north of Lake Athabasca in the Tazin Lake Upland Ecoregion of the Taiga Shield Ecozone. As a mining community, Uranium City and its residents experienced both the ups and the downs of a local economy dependent upon a single industry. By the late 1950s, the Uranium City area had a population of approximately 4,600, and between the 1950s to 1982, Uranium City offered a number of businesses and services to residents and visitors. Such businesses and services included banks, clothing stores, lawyers, grocery stores, schools, hospital, cafes and restaurants, a theatre, recreation facilities, lumberyards, taxis, trucking, janitorial services, churches, and federal and provincial government services, including those of SERM.

In mid-1982, the uranium mines and the mill at Beaverlodge were closed. This closure was a turning point for Uranium City. The community lost most of its businesses and services and its population dwindled. By the latter half of 1982, it had a population of only 800. Today, Uranium City is no longer considered to be a town; it still operates as a northern municipal community but is managed as a northern settlement. It is governed by a Local Advisory Committee consisting of four members, a chairperson and a secretary. The current population of Uranium City is approximately 200 and is composed of individuals of Dene, Cree, Métis and non-Aboriginal ancestry. This population level has been maintained for a number of years.



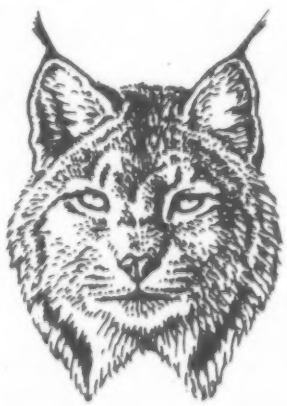
The main business section in Uranium City, August 1957. Saskatchewan Archives Board, Photograph #R-B6776(1)

Present-day businesses and services in the community include a post-office, general store, a hotel, hospital, school, organized recreational activities and a bulk fuel outlet.

3.6.4 The Northern Settlement of Camsell Portage

The Northern Settlement of Camsell Portage, the northernmost community in the province, is located approximately 36 km west of Uranium City along the north shore of Lake Athabasca in the Tazin Lake Upland Ecoregion of the Taiga Shield Ecozone. Buildings in this community include a school (kindergarten to Grade 9), church and a number of private residences. Camsell Portage also has an airstrip. Road access to Camsell Portage is not available. Main access to the community is by airplane and, also, by boat during the summer season.

People have lived in the Camsell Portage area since the early 1900s. The community's current population consists of approximately 40 individuals who are of Cree, Dene, Métis and European ancestry. Many of these individuals (and several residents of Uranium City) are ancestors of trappers who arrived in the area at the turn of the century from the NWT and Lac La Biche and Fort Fitzgerald, Alberta. Camsell Portage is located on what was once an important portage route to the north. At one point in time, 250 people lived in Camsell Portage and the community could support a fish cannery and local store. With the creation of Uranium City, many people moved from Camsell Portage to live and work. Various community services also were relocated to Uranium City.



Lynx

IV Condition: Status of the Taiga Shield Ecozone

4.1 Land

Settlement on the land is generally along waterways which were, and are, the principle travel routes. Communities are linked historically to fur trade travel and postings and, in later years, to the mining industry, i.e., Uranium City and Camsell Portage. With the possible exception of effects of climate change, the landscape, soils and groundwater remain as they have been for millenia.

4.1.1 Heritage Sites

Current practices respecting development of any kind recognize the importance of preserving heritage sites. Historical practices were, perhaps, not as considerate, but because development in this ecozone has been limited, impact on the heritage sites has also been limited. Known heritage sites in this ecozone that have not been impacted by previous, historical development are considered to be in a fair to good state of preservation, with only the processes of natural erosion contributing, in some cases, to their degradation.

4.2 Air

The Taiga Shield Ecozone enjoys good air quality due to limited human activity in the ecozone. On occasion, forest fires cause pollution by smoke. Broader issues that may affect air quality in this ecozone include acid rain, particulate levels, ozone depletion and climate change (SEPS, 1992a).

4.2.1 Human Health Impacts of Air Quality

Human health impacts of air quality are of a local, event-specific nature in the Taiga Shield Ecozone. Seasonal forest fire smoke can have an impact on air quality for quite a distance from the fire, even many hundreds of kilometres away. People are often evacuated as a precaution against the impacts of the smoke and, of course, the fire. Wood-burning activities/facilities, such as wood stoves, also create local air pollution.

Northern residents may be subject, on a local basis, to air pollution from operating snowmobiles, ATVs, outboard boat motors, portable electrical generators and chain saws on a regular basis. Indoor air pollution arises from overcrowding in homes, smoking and smoking by-products, various forms of home heating, such as wood stoves and fireplaces, and/or the storage of fuels and other similar items.

4.2.2 Acid Precipitation

Acid precipitation is a result of air pollutants, SO_2 (sulphur dioxide) and NO_x (oxides of nitrogen), mixing with water vapor in the atmosphere to create acids such as nitric acid and sulphuric acid and returning to the earth in the form of precipitation or on dust particles. Acid precipitation can deplete soil nutrients, harm plants, harm the flora and fauna of acidified waterbodies, increase respiratory problems, and increase the erosion and corrosion of natural and human-made structures.

In Saskatchewan, the sensitivity of the environment to acid precipitation varies with location. The Taiga Shield Ecozone, where soils and lakes are already acidic due to the nature of the natural vegetation and underlying rock, is more susceptible to acid precipitation than the more calcareous areas south of the Precambrian Shield. Northern regions are already near their tolerance level for acidification and careful monitoring is required (Interim Acid Deposition Critical Loadings Task Group, 1990).

Sources of acid deposition, such as mines, mills and smelters, are based outside the ecozone. Acid precipitation resulting from the development of the oil sands in northern Alberta is blown into Saskatchewan by the prevailing westerly winds and may affect the Taiga Shield Ecozone.

4.2.3 Particulates

In the Taiga Shield Ecozone, the primary sources of particulate pollution are local and short-lived and include smoke from forest fires and road dust. These reduce visibility and can affect health. It is believed that particulate matter of less than 10 in diameter can penetrate sensitive regions of the lungs.

4.3 Water

Water is plentiful in the Taiga Shield Ecozone, supplying a relatively small human population. Water quality is also still good, although this must be monitored. The importance of groundwater in the region is minimal when compared with surface water.

Broad beech-fern (Thelypteris hexagonoptera) in a rich white birch dominated riparian (streamside) woodland on the shore of Misaw Lake.
Robert A. Wright

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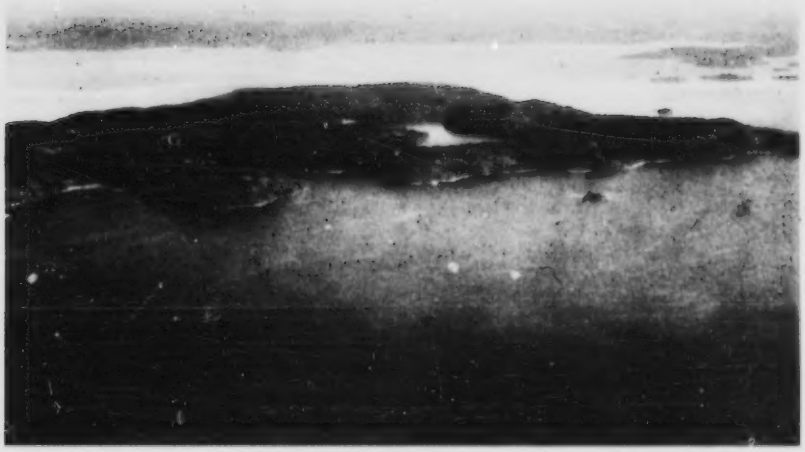
Table 7 **Selected Saskatchewan Surface Water Quality Objectives for the Protection of Aquatic Life and Wildlife**

Parameter	Objective (mg/L unless otherwise noted)
Arsenic (total)	**0.05**
Barium (total)	1
Cadmium (total)	**0.001**
Chlorine (total residual)	0.002
Chromium (total)	**0.02**
Cyanide (total)	0.01
Iron (total)	**1**
Lead (total)	0.02
Mercury (total)	**0.0001**
Nickel (total)	0.025 where hardness <100 mg/L ($CaCO_3$); 0.100 where hardness >100 mg/L ($CaCO_3$)
Oxygen (dissolved)	**6.0 – protection of early life stages of warm water biota** **5.0 – other life stages of warm water biota** **9.5 – early life stages of cold water biota** **6.5 – other life stages of cold water biota**
Selenium (total)	**0.01**
Silver (total)	0.01
Temperature	**Not to be altered more than 3°C from ambient water temperature**
Zinc (total)	0.05
Lindane (gamma BHC)	**0.0001**
Pentachloro-phenol	0.0005
Phenols (total)	**0.001**
Phenoxy herbicides (2,4 – D)	0.004
PCBs (total)	**0**
Unspecified substances	General objective of 1/100 of the 96 hour LC_{50} of such substances. Consideration is also given to objectionable taste, odor generation, and tainting flesh of aquatic life.

Source: SERM



Rocky islands clothed in very well-drained jack pine-lichen forest is common in Tazin Lake.
Robert A. Wright

4.3.1 Surface Water Quality

Water quality objectives are the recommended safe conditions, or limits, designed to protect each type of water use, such as drinking, recreation and freshwater aquatic life. In the Taiga Shield Ecozone water is relatively clean, but there may be non-potable water concerns around communities and through uses such as traditional resource use, commercial fishing and recreation. In general, the Saskatchewan *Surface Water Quality Objectives* (SERM, 1997d) for the protection of aquatic life and wildlife are applied for surface waters in the Taiga Shield Ecozone (Table 7).

The lakes within the region can best be described as pristine and having water quality that can only be characterized as excellent, with low dissolved solids (20-30 mg/L) and a neutral to slightly acidic pH. Major ions, trace metals and radionuclides are found in low concentrations, with the latter two often at, or near, analytical detection limits. The majority of the lakes must be considered oligotrophic (very low levels of primary productivity), usually with high levels of dissolved oxygen and Secchi disc transparencies in excess of 7 m (4 m would be closer to the average found at Tazin and Misaw lakes in 1999). Coupled with this, most of the lakes have low total hardness and low conductivity (see Tables 10 and 11, in Section 5.8, for water quality and sediment quality data collected in SERM's Ecological Effects Monitoring Program).

As of today, the vast majority of the surface waterbodies (lakes, rivers, streams, bogs and fens) in the Taiga Shield Ecozone have seen little or no negative impacts as a result of human activities or any other potentially degrading actions.

4.3.2 Surface Water Quantity

Surface water is abundant in the Taiga Shield Ecozone and serves the needs of wildlife and the human population. The largest river in the ecozone, with a mean annual discharge of 303 m³/s, is the Fond

Table 7 Selected Saskatchewan Surface Water Quality Objectives for the Protection of Aquatic Life and Wildlife

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Barium (total)	1	Silver (total)	0.01
Cadmium (total)	0.001	Temperature	Not to be altered more than 3°C from ambient water temperature
Chlorine (total residual)	0.002	Zinc (total)	0.05
Chromium (total)	0.02	Lindane (gamma BHC)	0.0001
Cyanide (total)	0.01	Pentachloro-phenol	0.0005
Iron (total)	1	Phenols (total)	0.001
Lead (total)	0.02	Phenoxy herbicides (2,4 – D)	0.004
Mercury (total)	0.0001	PCBs (total)	0
Nickel (total)	0.025 where hardness <100 mg/L ($CaCO_3$); 0.100 where hardness >100 mg/L ($CaCO_3$)	Unspecified substances	General objective of 1/100 of the 96 hour LC_{50} of such substances. Consideration is also given to objectionable taste, odor generation, and tainting flesh of aquatic life.
Oxygen (dissolved)	6.0 – protection of early life stages of warm water biota; 5.0 – other life stages of warm water biota; 9.5 – early life stages of cold water biota; 6.5 – other life stages of cold water biota		

Source: SERM

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4.3.2 Surface Water Quantity

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du Lac River. The Cochrane River has a mean annual discharge of 166 m^3/s.

While the river systems in the ecozone are considerable, by far the greatest share of surface water is stored in the lakes. Lake Athabasca has a volume of 97.8 $m^3 \times 10^9$. Although it is not in the Taiga Shield Ecozone, it is on the border and is greatly used by the residents.

4.3.3 Transboundary Water Management

Water from the Taiga Shield Ecozone crosses provincial or territorial boundaries. The MacKenzie River Basin Transboundary Waters Master Agreement (Tazin Lake and Athabasca Lake watersheds) and the Prairie Provinces Water Board (Churchill River) have established principles on water apportionment. There are no major water allocations in the Churchill River watershed and, hence, apportionment is not an issue. The Wellington, Waterloo and Charlot River hydroelectric projects, however, divert water into Lake Athabasca from Tazin Lake (Great Slave Lake Watershed). The amount of diversion is not great and there have been no downstream concerns.

During its 1968 to 1971 filling period, the W.A.C. Bennet hydroelectric dam in British Columbia on the Peace River lowered the normal summer water level of Lake Athabasca by 1.5 m. Weirs constructed on the Revillon Coupé and Rivière des Rouchers rivers in 1975 and 1976, on the outlet of Lake Athabasca, have essentially restored the lake's natural summer peak water levels. At the same time, the weirs have raised the minimum and mean annual water levels of Lake Athabasca by about 0.5 m.

Black Bay, Lake Athabasca. George Bihun

Woodcock Falls on the Fond du Lac River, 1949. Saskatchewan Archives Board, Photograph #R-B5762

4.3.4 Domestic and Community Water Supplies

The communities within the Taiga Shield Ecozone mostly depend on the abundant surface waters from lakes and rivers for domestic supplies. For both municipal and Indian reserve water infrastructure systems, surface water is the main source for the potable water. Fond-du-Lac has a well.

Uranium City operates its municipal water and sewage system according to the act, regulations and guidelines of SERM. With the closure of the Beaverlodge uranium mines and the mill in 1982 (the primary industry in town), the town's population is less than one tenth of its peak size. The population is expected to continue to fall; therefore, the infrastructure is more than adequate, with the primary concern being maintenance and upkeep of the system.

The largest community of the Taiga Shield Ecozone is Fond-du-Lac. It is located on an Indian reserve and falls under federal jurisdiction, which includes the water and sewage operations and infrastructure. The community has municipal water service supplied by three wells located on the reserve. The water treatment plant has storage capacity to accommodate fire protection services. Fond-du-Lac has an increasing population that will require housing in the future. Water supply and distribution services will be increased when the need arises. Water treatment operations are managed by the First Nation, with initial training and ongoing upgrading provided through the Prince Albert Grand Council.

The communities of Hatchet Lake First Nation and the Northern Village of Wollaston Lake have a common water supply and distribution system. The system is fed from a Wollaston Lake intake located on the southwest shore of the bay. Fire suppression volumes are incorporated into the storage capacity of the water treatment plant reservoir. It is anticipated that the overall population of the combined community will grow in the coming years and additional water supply and distribution services will be required. Training for the water treatment plant operators is provided through a circuit rider program delivered upon initial commissioning of a new system and on an as required basis from that point forward.

Camsell Portage is Saskatchewan's most northern settlement. Because of its small size, water and sewage systems are operated on an independent household basis. There are 11 residences (homes) in this community with a population of approximately 40 people. Of three original pump houses installed at the community, one remains in operation and supplies the school. At least seven homes have their own wells for a water source. These were either hand dug or installed with the use of an auger. Some systems have pressure systems for water distribution in the home, while others have manual pumps. The shallow water levels are "tied" to lake levels and correspond with fluctuating lake elevations.

Residents living outside communities rely on surface water for their supply. Water treatment depends on the needs of the individual or business. The use of untreated surface water for drinking is always a concern.

3.5 Effects of Hydroelectric Developments

Three hydroelectric stations (Waterloo, Wellington and Charlot River), whose source is Tazin Lake, operate in the Taiga Shield Ecozone. These generating stations, known as the Athabasca system, have a combined capacity of 23 MW. Hydroelectric systems often regulate water flow to provide the quantity of water necessary for the efficient production of electrical energy. While hydroelectric generation provides sustainable energy to northern communities, it may also impact the stability of aquatic and riparian habitats.

4.4 Wastes and Hazardous Material

4.4.1 Mining Waste Creation and Disposal Practices

Most mining operations in the Taiga Shield Ecozone had waste disposal facilities on their leased property. These disposal areas include domestic and industrial waste landfills. Since there are currently no active mine operations in this ecozone, the only wastes generated are by the local communities and exploration activity. Since Fond-du-Lac and Wollaston fall within an Indian reserve, Uranium City is the only community large enough to fall under SERM landfill guidelines. The Uranium City landfill continues in its original location and the town site has conducted regular cleanup drives initiated by the local citizens. This has included removal and disposal of abandoned materials and equipment left behind from the mining days.

Closed Gunnar uranium mine, July 1983. Ross Barclay

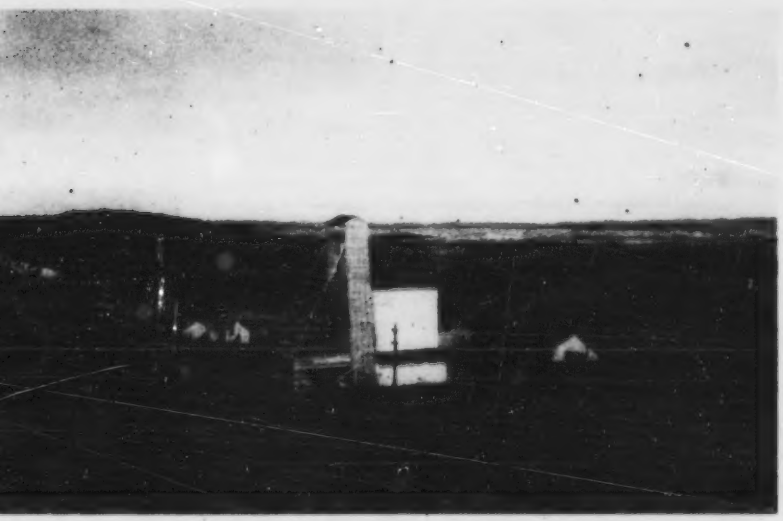
Of the abandoned mining operations in the Taiga Shield Ecozone, only three sites have tailings associated with them: Box, Gunnar and Lorado, located near Uranium City. A federal/provincial agreement is being negotiated for clean-up of the Gunnar and Lorado sites. SERM is currently working with the companies involved in the cleanup of the Box mine site.

The former uranium mine known as the Nisto uranium mine is located on what is now the Chicken Reserve #226, because the reserve was formed after the mine shut down in the late 1950s/early 1960s. A mine site rehabilitation program based on international, national and provincial standards or criteria was implemented during the summer of 1999.

Post-decommissioning monitoring still continues on the Beaverlodge site on the north shore of Lake Athabasca east of Uranium City. The mine/mill complex was closed in June 1982 and decommissioned and reclaimed in the next two and a half years.

4.4.2 Spills of Hazardous Substances

During 1998-99, SERM's Spill Control Centre responded to 255 spill incidents, of which none were located in the Taiga Shield Ecozone. There are 37 registered hazardous substances storage facilities in this ecozone.



view of the head frame of Lorado mine on Beaverlodge Lake, 1955. Saskatchewan Archives Board, hotograph #R-B5412(4)

4.4.3 Contaminated Sites

Amendment of *The Hazardous Substance and Waste Dangerous Goods Regulations* in March 1995 elevated storage facility requirements to a higher level of environmental protection. This will help to prevent future contamination from occurring at storage facility sites. Existing petroleum storage facilities are being upgraded throughout the area. Older underground fuel tanks are being replaced with above-ground environmental double-walled tanks. A new tank farm utilizing these environmentally safer tanks has been established in Uranium City.

The cleanup of contaminated sites, abandoned or unused facilities has also shown positive progress. The cleanup of a spill and site decommissioning is underway at the Bushell Bay Public Port facility. Discussions on the dismantling and remediation of the Imperial Oil terminal facilities at Uranium City are ensuing, and the cleanup of the diesel generator facility at the Fond-du-Lac dock has been completed. Another near future consideration is the decommissioning and cleanup of the former diesel generating site at Camsell Portage.

The Wollaston Lake Diesel Power Station was assessed for petroleum hydrocarbon contamination in 1993, after the power station was decommissioned. A follow-up investigation in 1999 also included assessment of the soil in the area of the former electrical substation for PCBs. Hydrocarbon concentrations in the soil at the fuel storage and pump house areas are higher than tolerance levels criteria. However, the impacts are restricted to surface soil and the concentrations are decreasing naturally. No PCBs were found in the area of the former electrical substation.

There is currently a need for a waste dangerous goods collection and disposal operation, including such items as used oil, batteries and antifreeze, to prevent them from being discarded into the environment.

Many of the old mines in this ecozone have contaminated areas where hydrocarbons have been identified. At the abandoned Nicholson mine site, further testing is required to determine if PCBs from the transformer building at the mine have contaminated the surrounding area.

As with other industrial sites, towns and airports, various remediation measures can be employed, depending on the degree and spatial size of the contamination. When a spill or contaminated site is found, local conservation officers are dispatched to assess and manage the situation to reduce any environmental impacts.

4.4.4 Domestic Sewage Disposal

All northern communities have licenced sewage disposal facilities operated in accordance with provincial laws and regulations, except for Camsell Portage, which is very small and deals with sewage on an independent household basis. In this case the school has a holding tank for sewage and the effluent is pumped to a rock disposal field about 100 m from the school. Private residents rely on grey water disposal on or near the ground surface. Private outhouses are used for disposal of human wastes, and new pits are dug when required. The shallow groundwater in this area is cause for serious concern due to previous and current disposal practices which could readily affect water quality.

Inspection of outfitter camps is a routine program for the northern health districts. A program will be undertaken in the year 2001 to confirm with outfitter's the expectation of meeting minimum standards for water treatment and sewage disposal.

The Department of Indian and Northern Affairs (DIAND) is responsible for sewer and water services for reserve communities, i.e., Fond-du-lac and Hatchet Lake. Fond-du-Lac has recently commissioned a new sewage lagoon. The former sewage treatment plant, located on the shore of Lake Athabasca, has been decommissioned; however, the discharge line remains in the lake. The location of the community and the undulating terrain in

Nicholson mine site, 1983. George Bihun

the area requires a number of lift stations to accommodate sewage collection. The First Nation public works division is very diligent about ensuring the systems operate properly.

Hatchet Lake and Wollaston Lake operate a common sewage collection system, with a two-cell sewage lagoon for effluent treatment. The DIAND provides effluent testing on a regular cycle to ensure there is adequate treatment.

4.4.5 Exploration Camps

Currently, the mining industry ensures that any exploration sites/camps are properly restored. Historically, though, extensive exploration left its imprint, with refuse left on site and associated line cutting activities. It was not until the late 1970s when camps were required to remove all garbage before all exploration camps were decommissioned.

4.4.6 Mine Openings

Through the years, many mines have been closed in this ecozone. Over time the material used to close these mines has settled and small openings have been discovered. Also, all the adits, or air vents, could not be located, to be closed, and are still open. As these open areas become

Open mine shaft. George Bihun

noted, steps are taken to ensure their proper closure. Monitoring is continued to watch for further openings.

4.5 Renewable Resources

4.5.1 Forestry

Forestry activities in the Taiga Shield Ecozone exist only at the local level, mainly for domestic uses. There are no designated forest management licence areas or reserve areas. The only other forestry activity that occurs in this ecozone is fire protection.

4.5.2 Forest Fire, Disease and Insect Damage

Forest fire and disease agents are the primary natural forest disturbances in the Taiga Shield Ecozone. It is difficult to measure the impacts or benefits of these disturbances. Fire is a natural component of the forest, but fire suppression has affected the natural fire cycles. It is a challenge to decide when and where fires should be aggressively suppressed and when and where they should be allowed to safely burn, considering ecological and societal values.

Linear drumlins formed of very stony till in the Selwyn Lake Upland Ecoregion (Walsh Lake). Note burned peninsula in foreground and unburned drumlin islands in centre ground. Small islands experience lower fire frequencies in the boreal forest. Robert A. Wright

There is currently no information on the presence of forest insects or diseases in the Taiga Shield Ecozone. Since spruce budworm depends on mature to over-mature forests, and given the fire frequency pattern for this area is about every 30 years, it is unlikely that the budworm would get established in this area. There may be outbreaks of forest tent caterpillar from time to time on aspen, although no surveys have been flown that far north.

4.5.3 Wildlife Populations

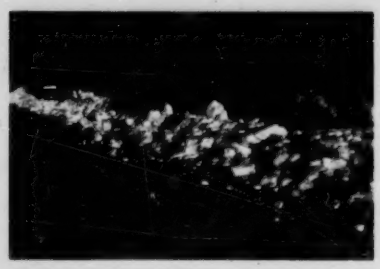
The Taiga Shield Ecozone has the lowest numbers and densities of wildlife species of any ecozone in the province, reflecting the harsh climate and lack of diversity in vegetation. The eastern part is particularly low, with somewhat higher productivity and species richness to the west, associated with the slightly warmer climate and more diverse vegetation.

Two herds of barren-ground caribou winter in the Taiga Shield Ecozone of Saskatchewan: the Beverly and Qamanirjuaq, so named for lakes near their respective calving grounds in Nunavut. Some years, as in the winter of 1999/2000, members of the Bathurst caribou herd also make their way into the province. Annual variations in distribution seem to be related to both snow depth and fire history. It can take 50-100 years for lichens to re-establish after a fire.

Barren-ground caribou are a valuable resource to the province. The last photographic census (1994) of the Beverly and Qamanirjuaq herds estimated populations of 286,000 and 496,000, respectively (see Figure 14 for a range map of the herds). The economic, cultural and spiritual value of the caribou is incalculable to the Dene and Métis of northern Saskatchewan. Traditionally, caribou were used for a multitude of items, from articles of clothing to tents. Today, caribou is still an important part of northerners' diet, helping to offset the high cost of foodstuffs shipped from the south. The annual harvest of these herds equates to $13.5 million, of which Saskatchewan users account for 30-50%. Residents of WMZ 76 may hunt two caribou of either sex during a regular season, while Aboriginal users may hunt for their subsistence needs. There is currently no commercial outfitting for barren-ground caribou hunting in Saskatchewan.

Caribou pass through a sedge meadow surrounded by black spruce forest, which supports the arboreal and ground lichen growth so vital to their survival. Terrestrial and Aquatic Environmental Managers Ltd.

In the past century, Saskatchewan barren-ground caribou populations have slowly declined. They do not range as far south into the province as they once did. Currently, one of the greatest threats to caribou, wherever they occur, is roads. Roads can increase human and predator access, act as barriers to caribou movement and reduce habitat availability. Roads such as the new Athabasca Seasonal Road from Points North to Black Lake are the greatest concern because they provide new access for unregulated hunters and can create the potential for significant increases in harvest levels. Restrictions on the use of roads for hunting will be difficult to establish and enforce. High vehicle traffic volume or snow walls created by snow plowing can restrict caribou from reaching widely distributed food sources.



Winter road. George Bihun

Climate change also has the potential to significantly affect caribou and their habitat. Changes in timing of spring melt, differences in summer temperatures, changes in the number of insects and parasites, as well as changes in the depth and hardness of snow and ice on lakes can affect animal survival, patterns of migration and the seasonal distribution of caribou. There is concern that as the global climate warms, an increase in the incidence of freezing rain or brief thaws will crust snowcover, impeding access to food below. On the positive side, the vegetation may get green earlier in the spring.

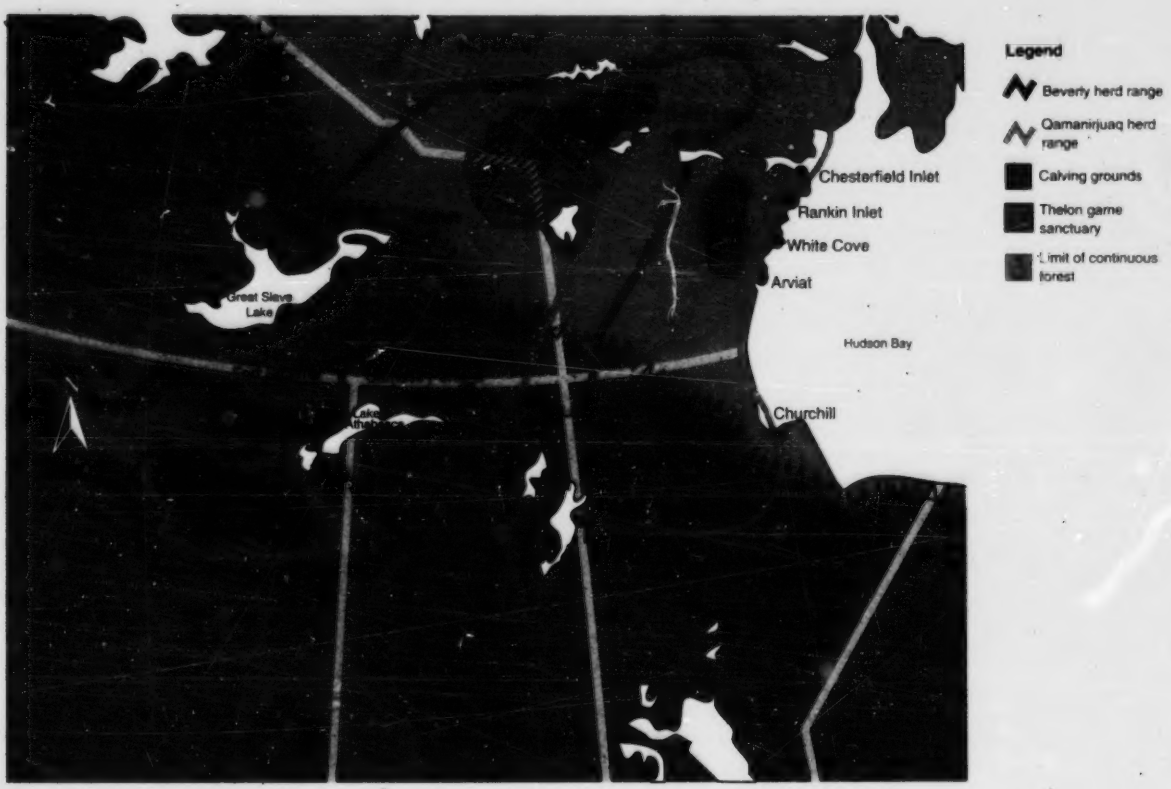
4.5.4 Subsistence Hunting/Fishing/ Trapping/Gathering

The people of the Taiga Shield Ecozone are dependent upon activities related to subsistence use of natural resources for personal and family sustenance. There is aconcern that access provided through the new Athabasca Seasonal Road will lead to increased pressure on these resources, as may activities related to mineral exploration and development.

Aboriginal people trapped and hunted for personal and trading purposes long before the arrival of Europeans. Today, trapping is not very profitable. Many trappers venture far north of the NWT border to trap wolves. Making these treks adds to the trappers' overhead and costs. While the profit margin is minimal and sometimes non-existent, many northern residents continue this traditional way of life.

Since 1946, fur harvests in the forested areas of Saskatchewan have been regulated through allocation of trapping to

Figure 14 Range Map of the Beverly and Qamanirjuaq Barren-ground Caribou



Source: Based on BQCMB. N.D.

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WOLVERINE

Despite its name, the wolverine is not related to the wolf, but rather it is one of the largest members of the weasel family. They are dark brown in color, with a paler head and a wide yellowish stripe on each side, which starts at the shoulder and meets at the base of the tail. The wolverine has large paws and, compared to most members of the weasel family, has relatively long legs. Wolverines are about 1 m in length, of which almost one-quarter is a bushy tail. Wolverines generally weigh between 10-15 kg, with females generally being smaller than males.

Wolverines are opportunistic feeders, eating almost anything they come across. They are primarily scavengers and eat carcasses left

continued on the following page

specific residents on particular NFCA's within the northern fur conservation block (NFCB). Thus, trappers must belong to a NFCA before they can take fur and must comply with any specific management activities prescribed on that area.

Table 8 summarizes the commercial harvest of furbearers in the Taiga Shield Ecozone relative to the provincial harvest. Commercial harvest is strongly influenced by trapping conditions and fur prices and is generally not a good indication of population status. Appendix 7 summarizes the status of Saskatchewan furbearers.

4.5.5 Fish and Other Aquatic Life

Annual fish production in the Taiga Shield Ecozone is low, at 1-2 kg/ha, even though water and habitat quality for fish and other aquatic life is relatively high and stable compared to southern areas of Saskatchewan. Low food availability within the aquatic food chain, plus cold water temperatures and shorter growing seasons, results in slow growth rates in the resident

Pristine environment - Tazin River, Tazin fault. George Bihun

fish. As angling pressure is light, large fish are caught more often than in the south, but these fish are older and more difficult to replace.

To help protect the fish resource in the Taiga Shield Ecozone, many lakes have reduced angling limits, called catch and release limits. These reduced limits may allow anglers to take only half of the provincial angling limit; or not allow anglers to retain any large, prime breeding fish; or in the most restrictive case, allow an angler to keep only one fish per day, which cannot be a large fish. While this ecozone encompasses only a small portion

Table 8 Commercial Marketing of Furbearer Pelts in the Taiga Shield Ecozone, 1994/95 through 1998/99, Inclusive

ORDER Family	Species	Common Name	Average Number Pelts Marketed Provincially	% of Pelts from Taiga Shield Ecozone
RODENTIA				
Castoridae	*Castor canadensis*	beaver	34,264	0.19
Cricetidae	*Ondatra zibethicus*	muskrat	71,993	0.03
Sciuridae	*Tamiasciurus hudsonicus*	red squirrel	14,093	0.40
CARNIVORA				
Mustelidae	*Mustela erminea*	ermine		
	Mustela frenata	long-tailed weasel	3,562	0.87
	Mustela rixosa	least weasel		
	Mustela vison	mink	3,450	10.83
	Martes americana	marten	3,294	15.82
	Martes pennanti	fisher	1,646	0.23
	Lutra canadensis	river otter	1,207	1.66
	Gulo gulo	wolverine	9	27.78
	Taxidea taxus	badger	279	0.00
	Mephitis mephitis	striped skunk	26	0.00
Canidae	*Canus lupus*	gray/timber wolf	234	3.93
	Canus latrans	coyote	10,108	0.01
	Vulpes vulpes	colored fox (red, cross, silver)	2,998	1.07
	Alopex lagopus	arctic fox	79	80.00
Felidae	*Lynx canadensis*	lynx	641	1.59
	Lynx rufus	bobcat	11	0.00
Ursidae	*Ursus americanus*	black bear	94	1.06
Procyonidae	*Procyon lotor*	racoon	937	0.00

Source: SERM

Table 9 **Canadian Species-at-Risk in the Taiga Shield Ecozone**

Threatened Category – Species likely to become endangered if limiting factors are not reversed.

Fish: Shortjaw cisco (*Coregonus nigripinnis*)
The shortjaw cisco, although considered mainly an eastern species, inhabits deep waters well below the thermocline in the lakes of the Arctic water basin. The status of the population is uncertain, but they are not considered to be abundant.

Special Concern – Species of special concern because of characteristics that make it particularly sensitive to human activities or natural events.

Mammals: Wolverine (*Gulo gulo*)
The wolverine is widely distributed in northern Saskatchewan. Its status is of concern because it appears unable to co-habit with humans, usually disappearing any time humans move into its home range.

of Saskatchewan. 33 of Saskatchewan's lakes and rivers with reduced catch and release angling limits are situated in this fragile area.

Fish habitat in the Taiga Shield Ecozone is relatively lightly impacted by human development, except for the Uranium City area where there has been considerable activity since the 1930s. This relatively fragile aquatic environment has proven reasonably resilient to the heavy use, but there has been some habitat damage and loss of lakes to mining developments. It is important to monitor ecosystems of the ecozone for any activities or trends that may affect fish populations.

4.5.6 Rare and Endangered Species

Compared to other ecozones in Saskatchewan, the Taiga Shield Ecozone has a small number of species listed by COSEWIC in 1998 as being at risk. Less than 1% of the human population of the province live in this zone and this limited development has saved both plant and animal species, from the dramatic habitat loss and resource exploitation characteristic of the more southern ecozones in the province. Only two species are currently considered to be at risk in this ecozone (Table 9).

COSEWIC conducts a national assessment of species, whereas Saskatchewan performs a provincial assessment. These assessments do not always agree as each has different priorities. Saskatchewan's major focus has been directed to grassland species. Therefore, the shortjaw cisco and wolverine are not on the provincial list. See Appendix 8 for the new provincial species-at-risk legislation.

Wolverine

Wolverine (continued)

behind by other predators, although they infrequently kill large prey such as caribou. They also eat birds' eggs, insect larvae, berries, roots, fish and mammals ranging in size from mice to deer.

The wolverine uses its keen sense of smell to find its food. It is a strong and ferocious animal, able to kill prey or defend itself from animals many times its own size. The wolverine also stores extra food in caches in trees or under the snow. It uses its scent gland to mark the food to discourage intruders.

The home range for a wolverine is huge: about 400-700 km² for males and 100-400 km² for females. They can travel tirelessly throughout their home range. They, however, do not move quickly but meander along for hours. Wolverines are also excellent climbers and swimmers.

The wolverine can be found in the northern half of the province. At one time they occupied all of the province, but they have since retreated to the more remote north. Various factors have been suggested for their reduced range. Wolverines appear to rely on large populations of ungulates for food. The late 1800s and early 1900s saw the buffalo disappear from southern Saskatchewan. Secondly, the 1950s and 1960s saw campaigns to poison the wolf, and as a result, many wolverines were also poisoned. Finally, wolverines prefer areas that are far from human activities.

Because wolverine fur is resistant to frost and to wear and tear, it is sought after for trim on parka hoods, cuffs and collars. The status of the wolverine is not known, but they are believed to be rare with a stable population. ❑

WOLVERINE

Despite its name, the wolverine is not related to the wolf, but rather it is one of the largest members of the weasel family. They are dark brown in color, with a paler head and a wide yellowish stripe on each side, which starts at the shoulder and meets at the base of the tail. The wolverine has large paws and, compared to most members of the weasel family, has relatively long legs. Wolverines are about 1 m in length, of which almost one-quarter is a bushy tail. Wolverines generally weigh between 10-15 kg, with females generally being smaller than males.

Wolverines are opportunistic feeders, eating almost anything they come across. They are primarily scavengers and eat carcasses left

continued on the following page

specific residents on particular NFCA's within the northern fur conservation block (NFCB). Thus, trappers must belong to a NFCA before they can take fur and must comply with any specific management activities prescribed on that area.

Table 8 summarizes the commercial harvest of furbearers in the Taiga Shield Ecozone relative to the provincial harvest. Commercial harvest is strongly influenced by trapping conditions and fur prices and is generally not a good indication of population status. Appendix 7 summarizes the status of Saskatchewan furbearers.

4.5.5 Fish and Other Aquatic Life

Annual fish production in the Taiga Shield Ecozone is low, at 1-2 kg/ha, even though water and habitat quality for fish and other aquatic life is relatively high and stable compared to southern areas of Saskatchewan. Low food availability within the aquatic food chain, plus cold water temperatures and shorter growing seasons, results in slow growth rates in the resident

Pristine environment - Tazin River, Tazin fault.
George Bihun

fish. As angling pressure is light, large fish are caught more often than in the south, but these fish are older and more difficult to replace.

To help protect the fish resource in the Taiga Shield Ecozone, many lakes have reduced angling limits, called catch and release limits. These reduced limits may allow anglers to take only half of the provincial angling limit; or not allow anglers to retain any large, prime breeding fish; or in the most restrictive case, allow an angler to keep only one fish per day, which cannot be a large fish. While this ecozone encompasses only a small portion

Table 8 Commercial Marketing of Furbearer Pelts in the Taiga Shield Ecozone, 1994/95 through 1998/99, Inclusive

ORDER Family	Species	Common Name	Average Number Pelts Marketed Provincially	% of Pelts from Taiga Shield Ecozone
RODENTIA				
Castoridae	*Castor canadensis*	beaver	34,264	0.19
Cricetidae	*Ondatra zibethicus*	muskrat	71,993	0.03
Sciuridae	*Tamiasciurus hudsonicus*	red squirrel	14,093	0.40
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Wolverine

Wolverine (continued)

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4.6 Culture and Heritage

With the introduction of mining, increased settlement and increasing adoption of Euro-Canadian technology, the traditional culture and lifestyle of the local Aboriginal peoples has changed, although subsistence is still a large part of their lifestyle.

The Dene of today live in permanent communities, rather than following the caribou, which, historically, sustained their life and culture. Although they established their communities close to caribou migration routes, the caribou have changed their migration patterns and no longer pass by these communities. Therefore, it is more difficult and expensive to hunt caribou than it used to be, as the Dene have to travel further to reach them, using costly technology, such as snowmobiles and airplanes. The Dene, therefore, need to supplement their "traditional" subsistence lifestyle with wage-type labor.

The Métis traditional culture is a mixture of Aboriginal and European cultures. Historically, the Métis have always been involved in a variety of occupations, especially as guides, packers and crewmen in the fur trade. They were also employed as clerks and translators, with the trading companies and churches. The Métis lived off the land, like the Dene, through hunting, fishing, trapping and plant and berry collecting, but did not rely on the caribou to the same extent.

Both the Dene and Métis rely on wage employment when available. Jobs are found mostly in the service industries, government, or by commuting to the mines in the Boreal Shield Ecozone. Trapping is another way to earn income but with today's fur markets, and the costs of maintaining a trap line, it is not very profitable.

The Aboriginal peoples of the Taiga Shield Ecozone continue to have a close attachment to the land and its resources, even though their lifestyle is not as dependent on the land as it used to be. Reliance on the land has been woven into their culture and spiritual beliefs. Developments of the land and the health of natural wildlife populations have effects that are social, spiritual, physical and economic. Healthy sustainable ecosystems are necessary for the people of the area to maintain their traditional lifestyle relationship with a healthy environment, while also receiving some economic benefit from it. All northerners have a strong stake in resource management decisions and are involved in land use planning and co-management agreements.

Metis guide John Mckay. Beverly and Qamanirjuaq Caribou Management Board

The "old way" - Dene and dog team near Stony Rapids, 1957. Saskatchewan Archives Board, Photograph #R-B6803

V Response: Management Initiatives Affecting the Taiga Shield Ecozone

5.1 Ecosystem Management

Ecosystem management is the integrated management of natural landscapes, ecological processes, physical and biological components and human activities to maintain ecological health and integrity of an ecosystem. It requires coordination and integration of existing activities, the development of planning initiatives at the local and regional levels and an increased understanding of ecosystem components and processes. Ecological monitoring, assessment and reporting are necessary to determine if the management goals are being met. There is still much to learn about ecosystems and how they function; therefore, ecosystem management involves an adaptive "learn as you go" approach.

In January 1999, SERM completed an *Ecosystem Management Plan of Action*. The plan is organized into eight broad categories: 1) Biodiversity and Ecological Integrity, 2) Water/Aquatic Ecosystems, 3) Ecological Framework, 4) Ecosystem-based Planning and Implementation, 5) Research and Monitoring, 6) Integration and Communication, 7) Economic Development, and 8) Aboriginal Affairs. This is a living document that will be continually revised to include new projects and issues, such as climate change, as they arise.

Ecosystem-based management programs in the Plan of Action, which are discussed elsewhere in this report, include the RAN and the ecological land classification program. The goal of the RAN program is to protect landscapes and the diverse ecological communities representative of each provincial ecozone. RAN sites will also serve as baselines or benchmarks in monitoring programs. The ecological land classification system provides a conceptual framework for ecosystem management by ordering or arranging different types of ecosystems into groups based on their similarities and differences. There are systems within systems: an ecozone, like the Taiga Shield, is a large, generalized ecological community, whereas an ecosite or ecoelement is the smallest classification unit, e.g., a small, local plant community. SERM, in conjunction with other agencies, has begun to develop an aquatic classification system, similar to the terrestrial system.

Other ecosystem-based management programs include the 1999 document, *Saskatchewan Water Management Framework*, which addresses the need for safe and reliable water supplies within healthy and diverse aquatic ecosystems. Indicators are being developed to use as measures of ecosystem health in a provincial monitoring program. A risk assessment model is now being used by SERM to prioritize issues within an ecosystem. Partnerships, consultations and co-management, with various agencies, governments and local groups, are also part of ecosystem-based management.

Waterfall on Ace Creek near Eldorado mine and townsite, 1978. Ross Barclay

Arctic Butte, a large bedrock hill near Misaw Lake. The open area at the summit of the butte is dominated by tundra vegetation including arctic willow and alpine azalea. Robert A. Wright

5.2 Mining Initiatives

5.2.1 Joint Review Group for Mining Activity

Government agencies involved in the environmental regulation of the uranium mining industry in the province include SERM, Saskatchewan Labour, Environment Canada, Canadian Nuclear Safety Commission (CNSC), Fisheries and Oceans Canada and Human Resources Development Canada. They originally established the Joint Review Group (JRG) for the decommissioning of the Beaverlodge properties. This group co-ordinates its activities, where possible, with the industry proponents to ensure similar regulatory issues can be addressed with one submission to all concerned parties.

5.2.2 Mine Decommissioning and Reclamation

The Taiga Shield Ecozone is rich in mineral resources and has historically supported a large number of uranium mines and one gold mine, most of them near Uranium City. Most of these sites, operated in the

1920s to 1980s, have been abandoned with minimum decommissioning and reclamation work, because they operated before more recent practices were developed, or considered necessary. Appendix 9 lists the abandoned mines in the Taiga Shield Ecozone. For the majority of the sites listed in Appendix 9, mining operations concluded in the early 1960s. See Figure 8 in Section 3.3 for locations of the historical mines.

In 1999 the Black Lake First Nation, with the support of SERM, DIAND, CNSC and the uranium industry, initiated a site rehabilitation at the former Nisto mine site located on Chicken Indian Reserve #226. The site work was completed in July of 1999, with follow-up testing done in the summer of 2000. SERM is currently conducting assessments of all known abandoned mines in northern Saskatchewan. This is a three-year program, with completion of a final assessment report anticipated in early 2003.

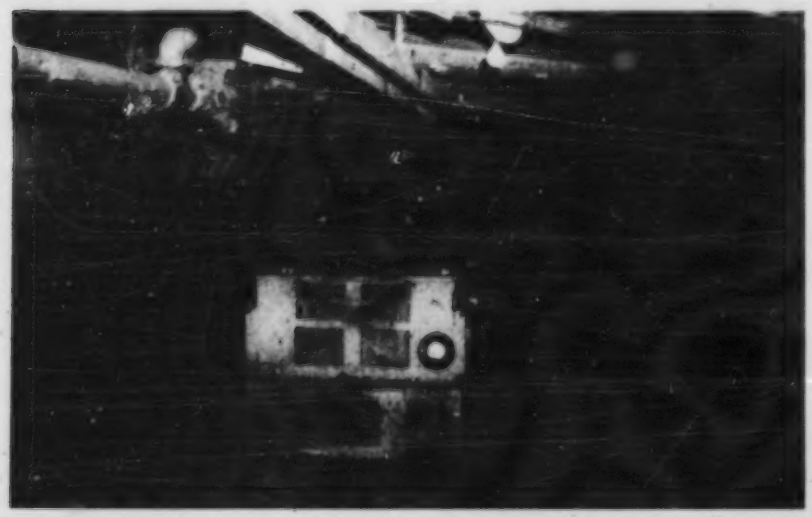
The majority of recent decommissioning activities in the Uranium City area have been done under licence by Cameco Corporation on the historical Beaverlodge properties, including a number of satellite mines surrounding the Beaverlodge area. Annually, Cameco conducts performance monitoring of past decommissioning activities and remediation on any licenced areas which require it. The end goal is to be able to leave the historical Eldorado Beaverlodge mining areas in an environmentally safe and stable condition. Approval from the JRG, in consultation with the Environmental Quality Committee (EQC) and members of the public, will be required prior to any release from the licenced site. SERM and the JRG also perform annual inspections of the Beaverlodge sites.

The owners of every mining operation in the province must provide a financial assurance of sufficient value to cover the full cost of implementing decommissioning and reclamation plans. Although companies have a legal responsibility to properly decommission and reclaim their mine sites, the regulations were developed to ensure that funds would be available for the necessary decommissioning and reclamation if the company became bankrupt or failed to perform the necessary work. Decommissioning and reclamation plans are reviewed on a regular basis to take advantage of any technological improvements and to accommodate the changing circumstances at a particular mine site. Reclamation of disturbed areas is done using vegetation species indigenous to the region.

The provincial government is currently negotiating with Natural Resources Canada towards a joint funding agreement for cleanup of the abandoned Gunnar and Lorado uranium mine/mill sites. The province's contribution for the cleanup of these sites will come from the Uranium Mining Contingency Reserve.

The Gunnar mine and uranium mill, located approximately 25 km southwest of Uranium City on Lake Athabasca, began production of uranium (U_3O_8) in 1953. An open pit was originally developed and underground mining started two years later. An estimated 4.4 million tonnes of tailings were discharged from the mill into Mudford (Blair) Lake, eventually flowing into Langley Bay, northwest of the site (Hovdebo, 1993). The site consisted of mining, milling and mining support facilities as well as other buildings, such as staff housing. The Gunnar operation was closed in 1964.

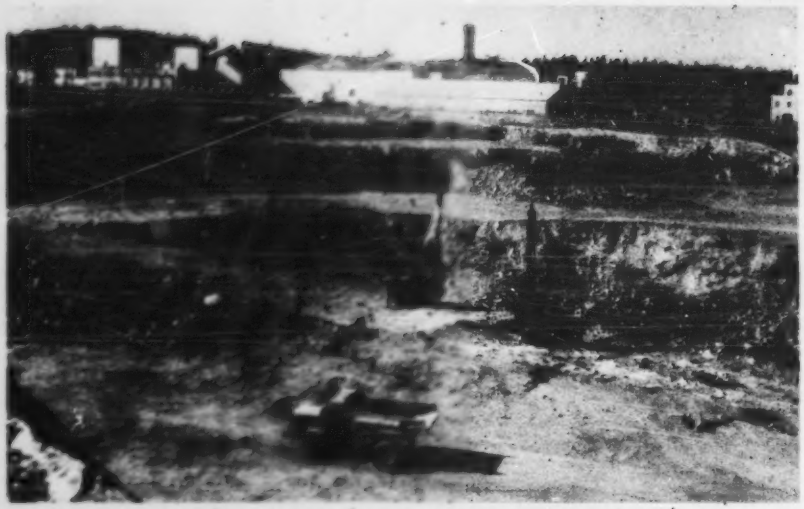
The Lorado facility is located approximately 10 km west of Uranium City, on the west shores of Nero Lake. The custom Lorado mill started producing U_3O_8 in 1957. The mill received ore from six major and 35 small scale mines in the area (Kalin, 1982). Tailings were pumped from the mill and deposited near the shores of Nero Lake. By the end of operations in 1960, there were approximately 14 ha of exposed tailings on the shore of Nero Lake. The tailings have had a significant impact on the water quality of the lake, which is now acidic and saline (Hovdebo, 1993). In 1990, the first step in decommissioning and reclaiming the site was undertaken by demolishing the mill.



An underground train on level 6 in Eldorado mine. Saskatchewan Archives Board, Photograph #57-315-75

5.2.3 Environmental Quality Committees

EQCs were established by the provincial government in 1995. The EQCs are a mechanism for northern communities to interact with government and industry on uranium mining activities, including environmental protection, worker health



Open pit at Gunnar uranium mine in Beaverlodge area. Drills in foreground prepare holes for blasting. Mill in background. Saskatchewan Archives Board, Photograph #56-305-62

and safety, and the socio-economic impacts of the mines. The EQCs also enable government and industry to share information with northerners on uranium mining projects and serve as a bridge between northerners, government and the uranium industry.

There are three EQCs (West Side, South Central and Athabasca), composed of representatives of the designated "impact communities" as defined in the Human Resource Development Agreements negotiated for each uranium mine. The Athabasca EQC represents impact communities of the Rabbit Lake, McLean Lake, Midwest and Cigar Lake Mines. Four of these impact communities are all in the Taiga Shield Ecozone: Camsell Portage, Uranium City, Fond-du-Lac and Wollaston Lake. The other impact communities, Black Lake and Stony Rapids, are in the Boreal Shield Ecozone, in the Athabasca Basin area.

5.2.4 Northern Mines Monitoring Secretariat

The Northern Mines Monitoring Secretariat (NMMS) was established by the provincial government in 1994. Operating under the auspices of Saskatchewan Northern Affairs, the NMMS is responsible for collecting information on uranium mining activities from government and industry and communicating the information to northerners and other interested parties. The NMMS also serves as an administrative support structure to the EQCs, providing information, coordination and communication services.

The NMMS consists of representatives of all provincial government departments that have a direct role in the uranium industry in northern Saskatchewan, including Northern Affairs, SERM, Labour, Post-Secondary Education and Skills Training, Health, SEM, and Municipal Affairs and Housing. Two federal agencies, DIAND and CNSC, are also members of the secretariat.

5.2.5 Uranium Mining Contingency Reserve

In 1980, the Government of Saskatchewan created the Environmental Protection Reserve, to be used to fund reclamation work on abandoned uranium mine sites, monitoring and maintenance activities of decommissioned uranium mine sites, and any unforeseen environmental expenses arising from the mining and milling of uranium in Saskatchewan.

The level of the reserve (now called the Uranium Mining Contingency Reserve), which is part of the provincial government's General Revenue Fund, is currently $11.94 million.

5.2.6 Cumulative Effects Monitoring of Uranium Mining

In 1994, SERM initiated the Cumulative Effects Monitoring (CEM) program in response to the joint Federal-Provincial Panel on Uranium Mining Development in Northern Saskatchewan. This program is long term and covers a large area, since there is a possibility of contamination at a great distance from the mines. Analysis of samples taken on a regular, repeated schedule at permanent stations will establish the normal background levels of selected contaminants for those sites and, at the same time, draw attention to any sudden increases in contaminant levels. The CEM program was developed to ensure that sufficient baseline data is available for future comparison, followed by repeat sampling to assess the level of impact, if any, observed over time or as a result of increased mining and milling activity in a particular region.

The CEM program monitors both class and regional effects. Class effects are those which might occur when a class of similar developments (or projects at a single development) has the potential to overlap spatially or temporally. These are generally more local in nature, such as when effects in two watersheds converge. Regional effects are those which could possibly occur from the long-range transport of contaminants over extended periods of time. Regional stations serve as a historical baseline (albeit post mining) on water chemistry, sediment chemistry, and fish chemistry and health. These stations are compared to background stations, which are more remote from any influence of mining activities.

Three class stations have been established, all in the Boreal Shield Ecozone: at Cluff Lake, Key Lake, and on the west side of Wollaston Lake. Eighteen

regional stations have been established at various locations throughout northern Saskatchewan. Background stations are located on Lake Athabasca and Wollaston Lake in the Boreal Shield Ecozone and on Black Lake in the Taiga Shield ecozone. Sampling takes place on a three-year rotation.

The CEM program is also involved in an extensive amount of site-specific monitoring to assess the short, medium and long-term effects of uranium-treated effluent discharges on the receiving environment. This work includes analysis of the structure and diversity of the aquatic community downstream of uranium mining and milling facilities and assessing the impact, if any, that these treated effluents have had, or are having, on the health of that community. Included are an assessment of each identified parameter within the treated effluent, including all forms of radiation (alpha, beta and gamma) as well as heavy metals and any other potentially harmful contaminants.

A CEM working group has been established, with participants from research organizations, consulting firms, the uranium mining industry, the NMMS and various federal and provincial regulatory agencies. The CEM working group, co-chaired by the CNSC and SERM, designs and manages monitoring plans, co-ordinates data collection, assesses and analyzes monitoring data, models environmental impacts, and conducts special research and studies.

In September 1998, SERM signed a Memorandum of Understanding (MOU) with the Athabasca, West-Side and South-Central EQCs regarding the CEM program. The CEM program and the Shield EcoRegion, an administrative region of SERM, agree to consider all reasonable recommendations, to make all reasonable effort to maximize the involvement and to ensure that the EQCs receive, in a timely manner, all reports of the CEM program.

An increasingly important component of the CEM program is communication with northern residents and their involvement in sample collection.

5.3 Acid Precipitation

The soil, vegetation and water in the Taiga Shield Ecozone are vulnerable to acid deposition because the buffering capacity against acid depositions in this area is very low. This low buffering capacity makes it necessary to provide special care to ensure that the uniqueness of this ecozone remains protected.

Depending on climate conditions, the emissions from the tar sands operations in Fort McMurray, Alberta may travel to northwest Saskatchewan and have impacts on very sensitive northern environments. Therefore, Saskatchewan has formed the Tar Sands Working Group to evaluate activities in the Fort McMurray area. As well, Saskatchewan is working closely with Environment Canada to determine, using long-range transport models, the amount and locations of this deposition. The additional information, combined with data from existing monitoring programs will enable SERM to evaluate the severity of these activities and to determine if this deposition is affecting areas such as the Taiga Shield Ecozone.

5.4 Water Management Initiatives

5.4.1 Saskatchewan Water Management Framework

In January 1999, the Government of Saskatchewan released its Water Management Framework. The framework addresses protection of water and wetlands, management and development of water resources, increased public involvement in decision-making and better coordination of government activities. It establishes goals and objectives for water management and identifies 58 specific actions government can pursue to achieve these goals.

Of the actions included in the framework, SERM has responsibility to lead in 14 and to co-lead with SaskWater in another four. Some actions are being undertaken quickly, with little cost. Others represent significant costs and/or have significant implications to basic management in the province and require further public consultation. The importance of drinking water to Saskatchewan residents is emphasized in the framework, as drinking water quality is associated with 13 of the 58 action items. The following actions have been initiated by SERM and are in various stages of development:

Develop indicators and monitor the health of drinking water sources and aquatic ecosystems.

- This action item is a key component of an ecological monitoring program to determine overall health of aquatic ecosystems, including sources of drinking water. Data collected will help guide future water resource management and also identify existing significant problems and new threats.

Establish criteria for measuring aquatic ecosystem integrity, which can be used to meaningfully guide economic development activities.

- Variables are being selected to indicate integrity and are closely related to maintenance of essential environmental processes (e.g., water level fluctuations) and ecosystem functions (e.g., primary production) and indicate changes in entire

Nesly River near Uranium City. George Bihun

communities rather than on a micro scale. Variables which can be measured for pollution, habitat, exotic species, global warming and over-harvest of species are included.

Ensure that aquatic ecosystems and riparian areas are considered in the RAN.

- Representative areas are natural areas that have been relatively undisturbed by intensive or commercial activities. The RAN is a comprehensive system of ecologically important lands and waters that will aid in conservation of provincial biodiversity.

Review screening procedures and expand existing protocol regarding non-native plant and animal introductions into Saskatchewan.

- A new policy to provide a consistent approach and to protect ecological integrity against introduction of disease is being developed. The federal Department of Fisheries and Oceans (DFO) protocol on introductions and transfers of fish and other aquatic organisms is being considered for adoption. A discussion paper on other exotic species has been developed.

Develop policy for conserving riparian habitat on a watershed basis.

- Riparian areas are those habitats adjacent to banks of rivers, lakes or other waterbodies. A policy identifying benefits of riparian areas and providing a framework for their protection is required. Riparian area conservation guidelines for specific watersheds will later be developed.

Promote more buffer strips and environmental reserves to assist aquatic ecosystems to withstand activities such as forestry, agriculture and mining.

- A program to achieve greater protection on private and Crown lands is being developed. The program will incorporate conservation easements, replanting buffer strips, instituting land use guidelines and increasing extension efforts.

Conduct additional field research and monitoring on the effects of pesticide, nutrient and sediment impacts, and develop strategies to reduce impacts.

- An expanded program of ongoing monitoring and assessment of major waterbodies is needed, as is research to establish a water quality index for assessing waterbodies. Additional research is also required to develop methods of managing common problems such as algal toxin, weed growth, fish kill and impact of acid rain in lakes and rivers.

Develop and implement best management practice guidelines to reduce impacts of urban runoff.

- Storm water runoff in urban areas is often contaminated with various water pollutants which are byproducts from urban activities. These include automobile use, lawn and garden care and industrial processes. These pollutants can damage aquatic life in downstream lakes, streams and wetlands.

Clarify role and reporting function of the Water Appeal Board.

- The legislation, role and reporting function of the Water Appeal Board is currently under review to ensure timely and effective water management decision-making. The Water Appeal Board serves as a mechanism to anyone appealing a regulatory decision of SaskWater.

Implement mandatory operator training and certification for water and wastewater operations.

- Certification of water and wastewater treatment operators helps ensure staff at treatment plants are competent and efficient.

Review municipal water and wastewater treatment operations and monitoring practices and provide support and advice as appropriate.

- Water quality monitoring needs, data collection for chemical and bacteriological quality of treated water and design guidelines for construction and operation of facilities need to be reviewed. In addition, a national working group which includes provincial and federal representatives has been established to develop, update and implement water quality guidelines.

Explore opportunities for increased development of the aquaculture industry.

- Because of increasing interest in expanding the aquaculture industry in Saskatchewan, a development strategy will provide environmental protection guidelines to protect ecological integrity and ensure economic sustainability. This strategy will remove roadblocks to aquaculture development, facilitate industrial development and streamline the review and approval processes.

Streamline the approval process for licencing water-related projects.

- Existing processes are out of date and complicated. A new strategy is being developed based on an ecosystem approach to management.

Enhance and integrate the provincial water quality database so that it can be easily shared by agencies and organizations.

- Data collection protocols and networks have to be adequate for their intended use and in a format that can be shared by agencies. This is necessary to minimize duplication (several agencies collecting data that is essentially the same for different purposes) and increase efficiency.

5.4.2 Hydroelectric Reservoir and Flow Management

Water for the hydroelectric stations in the area is supplied mainly from Tazin Lake. Water flows that normally run north are controlled by the Tazin Lake Dam and are rerouted south to the Charlot River, which in turn supplies the Wellington, Waterloo and Charlot River hydroelectric stations.

Water levels and flows for the generation of hydroelectric power are set within the design limits of the hydro stations. As a result of low water levels in recent years, hydroelectric generation has been below average and little excess water has been spilled to the Tazin River.

5.4.3 Municipal Water and Sewer Infrastructure

Recognizing the effect upon human health, the quality of community life and the environment, the provincial government has initiated a mandatory operator certification program. This program is intended to provide a provincial standard of knowledge and skills for operators of water and wastewater treatment systems in all communities. The inherent high costs associated with the remoteness in northern Saskatchewan will require future initiatives and support to benefit any projected growth and development. Some communities in the Taiga Shield Ecozone are too small or lack the resources to invest in necessary water and sewer infrastructure.

SaskWater provides assistance to northern communities in training water and sewer works system operators.

5.5 Pollution Prevention and Waste Management

The Taiga Shield Ecozone has 37 registered storage facilities, including underground and aboveground storage tanks, chemical warehouses, outdoor storage and hazardous waste storage. These storage facilities are continually being upgraded and contaminated sites are being remediated. The Nisto mine adit was sealed in 1999 to alleviate concerns over public safety and radiation. Coast Guard Canada has contracted out the clean-up of the petroleum hydrocarbon spill and site decommissioning of the Buahell Bay Public Port facility. Post-decommissioning work continues at Beaverlodge and satellite mine sites around Uranium City. New technology and conservation officer involvement in environment pollution prevention will continue to assist in lowering levels of discharge of pollutants.

Since 1992, nine contaminated sites, which were predominantly hydrocarbon related, have been identified on reserve lands within the Taiga Shield Ecozone. These sites have been remediated.

5.5.1 Spill Control

In Stony Rapids, SERM has staff who are trained for initial spill response and to authorize proper clean-up procedures. Major spills of hazardous wastes require the assistance of a more highly trained on-call responder. Hazardous spills are reported through the 24-hour provincial dispatch, and are followed up to ensure adequate containment and remediation.

5.5.2 Domestic Sewage and Landfill Initiatives

Sewage disposal for Camsell Portage is being addressed through the Northern Water and Sewage Infrastructure Study being conducted by Saskatchewan Municipal Affairs and Housing.

The DIAND has implemented an extensive program since 1989, installing modern sewer and water services to the First Nation communities of Fond-du-Lac, Black Lake and Hatchet Lake. Fond-du-Lac's sewer and water system was constructed in 1989, with upgrades in 1995 and 1998. Black Lake's sewer and water system was constructed in 1993 and 1994, with a total of 179 houses serviced. Hatchet Lake's sewer and water system was constructed in 1989, with water system upgrades in 1995 and sewer system upgrades in 1995 and 1998. These communities are 100% serviced and any new construction will be for expansion to meet new house servicing needs.

Garbage disposal in this region requires improvement. Conservation officers in Stony Rapids and Wollaston are working with communities to address this issue. Two reserve communities within the Taiga Shield Ecozone have developed landfill sites as a result of the Indian and Northern Affairs Saskatchewan Region Solid Waste Management Site Development and Management Initiative. This initiative is long term, and eventually all reserve communities within this ecozone will be developing solid waste management sites and/or implementing solid waste management programs which meet standards set by the Province of Saskatchewan.

5.6 Environmental Assessment

5.6.1 Environmental Assessment Legislation

The Environmental Assessment Act provides that SERM review proposed private sector and public developments that have a potential to impact the environment. Projects are screened to determine if they require approval under the act. If a project is considered to be a "development" under the act, the proponent must complete an Environmental Impact Assessment (EIA) and prepare an Environmental Impact Statement (EIS). The EIS is subject to government review and is also made available for review by the public, who have the opportunity to comment directly to the Minister prior to a decision. The project must receive approval from the Minister of SERM before it can proceed. Project approval often carries with it a number of conditions to reduce the development's environmental impact.

Under section 14 of *The Environmental Assessment Act* the Minister of SERM retains the option of appointing a public inquiry into a development proposal at any time prior to making a decision on that development. In 1991 the Minister exercised this option and, in conjunction with the federal government, established the independent Joint Federal-Provincial Panel on Uranium Mining Developments in Northern Saskatchewan to publicly review the proposals for new uranium

mining developments. The joint panel was also mandated under *The Public Inquiries Act* to review broader issues raised by uranium development which fall outside of the *Environmental Assessment Act*, including cumulative environmental effects assessment, employment and training objectives for northerners, northern development matters and occupational health and safety.

The federal environmental assessment process is intended to review projects involving the federal government. The process is guided by the *Canadian Environmental Assessment Act* (CEAA) and its regulations. It applies to projects proposed or funded by a federal agency, as well as to those for which a federal agency grants an interest in land or exercises a specific regulatory power. The CEAA allows the federal government environment minister to enter into bilateral agreements with provincial and territorial governments to coordinate environmental assessment processes.

5.7 Renewable Resource Management Activities

See Appendix 8 for species-at-risk legislation.

5.7.1 Crown Land Management Steering Committee

Crown land makes up the majority of the land in the Taiga Shield Ecozone and government has changed the way it manages it. Increased and varied land use, conflict among users, involvement of affected users, environmental and economic concerns, and changes in public perception have created an environment where government requires input from all people affected and interested in sustainable land management.

A Crown Land Management Committee, which includes all government departments and agencies, is involved in administering Crown land functions. One of the main focuses of this committee is to analyze land use and policy issues and identify new approaches for achieving an optimal balance among social, economic and environmental benefits from Crown land.

5.7.2 Integrated Land Use Plans

Integrated Land Use Plans (ILUPs) provide a framework for resource management decision-making that will ensure that the health of the ecosystem is maintained, while allowing for a balance of sustainable benefits from resources, including environmental, economic, social and cultural. The ILUPs are prepared using broad public consultation, to ensure that all uses and values of resources are considered.

In March 2000, SERM entered into an Agreement Respecting the Land and Renewable Resource Use Planning and Management in Northern Saskatchewan – Lake Athabasca Region with the First Nations and municipal communities situated in the Athabasca Basin. The Agreement proposes that SERM and the three northern Dene Nations (Black Lake, Fond du Lac and Hatchet Lake), the northern municipalities of Stony Rapids, Uranium City and Camsell Portage, along with the Prince Albert Grand Council, key government departments and non-Aboriginal resource users co-operate in a number of areas:

- to undertake land use planning for provincial Crown land and renewable resources found in the basin, which is required as a result of access created by the Athabasca Seasonal Road, a new winter road from Points North to Black Lake and Stony Rapids to Fond-du-Lac;
- to create a permanent regional planning and management body consisting of First Nations, northern municipalities, government department and stakeholder representatives to co-manage the environment, renewable resources and Crown lands in the designated planning areas; and
- to explore how various land and renewable resource use planning and management responsibilities and authority could possibly be delegated to this regional body.

The agreement speaks to a staged process beginning with an area extending 25 km on each side of the Athabasca Seasonal Road (50 km width in total) for its full length from Points North to Stony Rapids and on to Fond-du-Lac; second, an area including the Fond du Lac River Valley, the Athabasca Sand Dunes Provincial Wilderness Park, the Saskatchewan portion of Lake Athabasca, and a 25 km corridor along the north and south shores of Lake Athabasca to the Alberta border and reserve lands; and finally the remaining northern Athabasca region.

See Figure 15 for a map of the planning areas and stages.

5.7.3 Enforcement and Compliance Framework

In 1995, SERM developed and adopted an *Enforcement and Compliance Framework*. The framework recognizes that the three key tools for achieving compliance are public education, prevention and enforcement. A guiding principle is that

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M121

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The young man looks at our abounding Canadian wildlife, and thinks that we have a precious heritage; the old man looks back at his youth and mourns for the vast numbers of wild things that now exist in a mere shadow of their former abundance; and whether young or old, we need to keep this matter constantly in mind, and be prepared to do our bit to hand on to our successors as full a measure as possible of the wildlife that we have enjoyed. ❑

Source: Saunders, William E. 1937. Canadian Science Digest. [December].

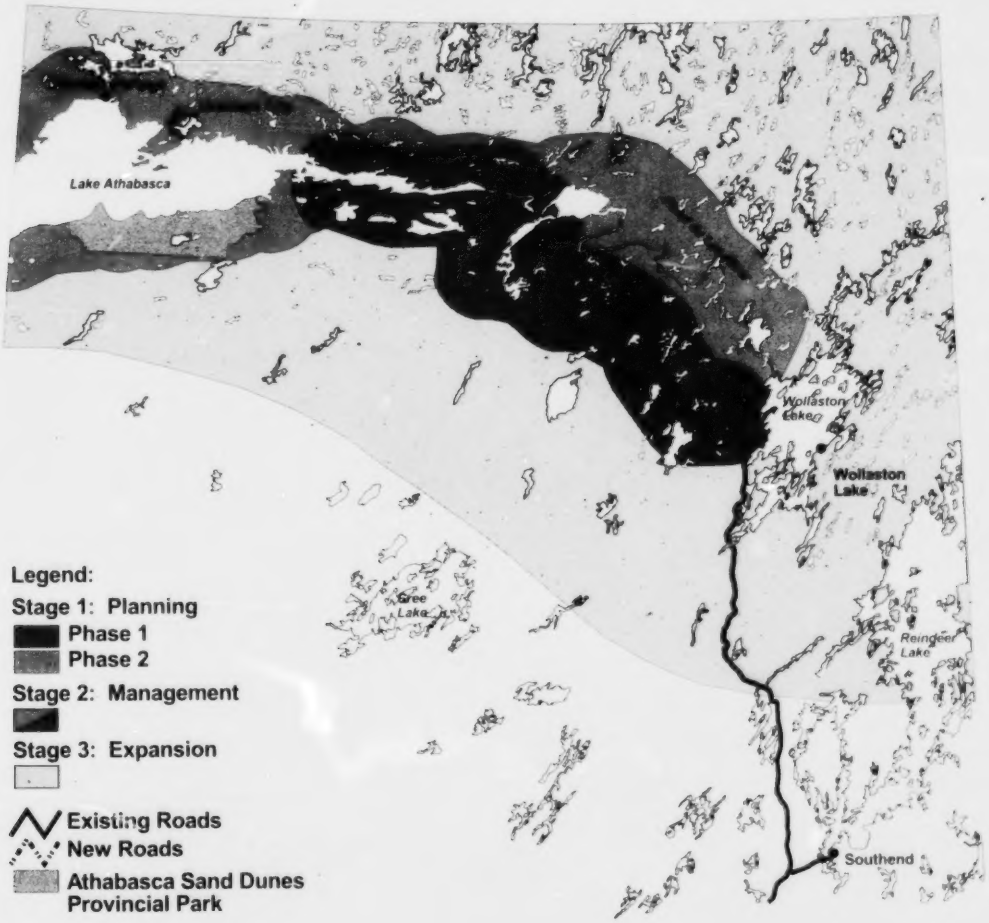
compliance can be maximized through inclusion of the public and stakeholders, building consensus in resource and environmental management decisions. Prevention and public education programs will be the major focus of compliance activities.

Related to this framework, SERM is developing a strategic approach to enforcement and special investigations to ensure that limited resources are targeted to the highest priorities. The department is determining the best strategic approach for incorporating compliance monitoring and enforcement into its new model of ecosystem management. Conservation officers are being trained in environmental regulations and are assuming a strong enforcement and compliance supportive role.

Arctic grayling spawning in Don Creek near Uranium City. George Bihun

The degree and/or frequency of the enforcement actions depend on the seriousness of the infractions and the impact on the resource. Resource user

Figure 15 **Planning Areas and Stages of the Northern Saskatchewan – Lake Athabasca Region Agreement**



The young man looks at our abounding Canadian wildlife, and thinks that we have a precious heritage; the old man looks back at his youth and mourns for the vast numbers of wild things that now exist in a mere shadow of their former abundance; and whether young or old, we need to keep this matter constantly in mind, and be prepared to do our bit to hand on to our successors as full a measure as possible of the wildlife that we have enjoyed. ❑

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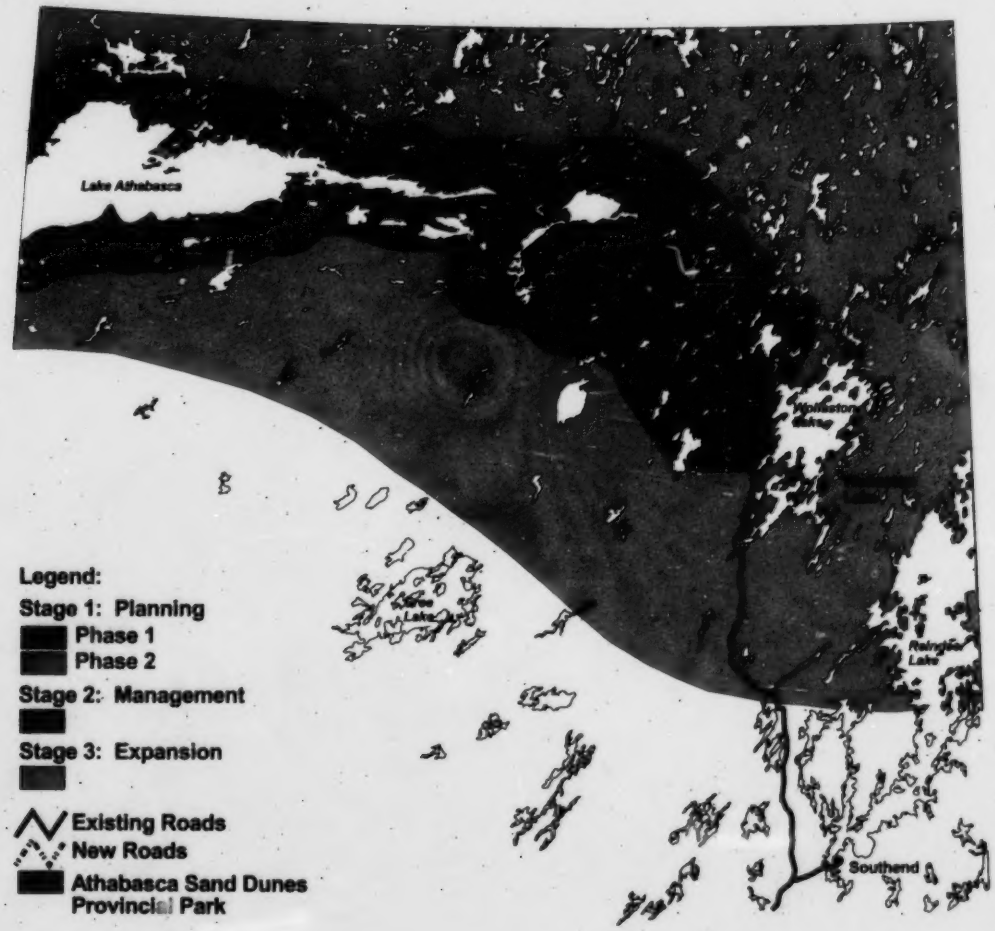

compliance checks ensure the legal and safe harvesting of renewable resources. Special investigations are used to gather evidence of illegal commercial operations.

The compliance and enforcement program in the Taiga Shield Ecozone is focused largely on the sustainability of wildlife populations, as levels of harvest and wastage of wildlife are a continuing concern.

5.7.4 Provincial Representative Areas Network

SERM is leading the establishment of a network of ecologically important land and water areas across the province, through a system called the RAN. This system started with a base of sites totaling nearly 3 million hectares (7.4 million acres) including national and provincial parks, wildlife refuges, ecological and other reserves in the province. Working from this solid foundation, Saskatchewan's RAN has expanded by about 1.7 million hectares since 1997.

One of the primary goals of the RAN program is to protect biodiversity, the richness and variety of life, by selecting and designating areas representative of Saskatchewan's natural ecological diversity. An objective and consistent method for assessing this diversity was developed to guide the choice of representative area selections. Notably, an enduring features approach to define the range of diversity in Saskatchewan was selected. Enduring features, such as specific rock, soil and landform patterns, are considered to be very stable over long periods of time and are likely to contain characteristic plant and animal communities. Classifying the province into different enduring feature groupings and measuring the level of protection already afforded to specific landscape types (and associated plant and animal communities) highlighted deficiencies in terms of protection. Landscape types with little or no protection were rated a high priority for action in the RAN.

Arctic bearberry (Arctostaphylos rubra) growing with reindeer lichen (Cladina mitis) and moss in an open black spruce forest. Robert A. Wright

The scientific approach for selecting representative areas is also blended with the wealth of local knowledge gathered through land use planning and other community based consultation processes. Suggestions and needs identified through this process help determine the kinds and levels of activity that may occur within designated sites. Regulations developed through this process govern activities in each site and are intended to reflect the diversity of goals and values that are meant to be protected.

Representative area designation is flexible in nature, supporting many resource pursuits such as trapping, hunting and fishing. However, site management seeks to limit activities like commercial logging, road construction and mining or petroleum exploration and development within the sites. The intention is to ensure long-term resource protection within representative areas by minimizing disturbance and degradation.

Three representative areas are currently proposed and under discussion in the Taiga Shield Ecozone, including the Tazin Lake Representative Area (124,181 ha), the Chappuis/Fontaine Lakes Representative Area (319,653 ha) and the Misaw Lake Representative Area (341,343 ha). In conjunction with the integrated land use plan initiated for the Lake Athabasca region, as described in section 5.7.2, the boundaries and management plans for these sites will be finalized over time. In the interim, it is proposed that the sites be afforded protection in the form of a temporary management plan that will help to maintain

Leaning forest at the shore of Hasbala Lake in the proposed Misaw Lake Representative Area. The black spruce trees in the photo are all growing on a type of permafrost peatland called a peat plateau, located adjacent to the southeast corner of the lake. The lake waters help thaw the peat at the water's edge and as the thawed peat decomposes and collapses, the shoreline black spruce topple into the lake. Robert A. Wright

each site's ecological values until final management plans or strategies can be completed and formal designations occur.

Government commitment to live up to the challenge of establishing a RAN for the people of Saskatchewan remains strong. Public discussions for proposed representative areas will proceed throughout the central and northern part of the province to bring together a mix of perspectives on the land to identify the full range of values that may need long-term protection. Following this process, new designations will be announced in the coming months.

See Appendix 10 for RAN milestone accomplishments.

5.7.5 Fire and Forest Insect and Disease Management

Over the past number of years, SERM has been working to update or create new policies to guide forest management in the province. There have been a number of advances in the theory and practice of fire management, since the province created its current fire protection policies over 20 years ago. Insects and diseases are now impacting forest resources at a steadily increasing rate, and there is currently no clear policy on government's management or protection role here.

Forests provide a wide range of local and global ecological benefits. The traditional way of viewing fire and forest insects and diseases is that they are bad, and should be eliminated. Ecologists now recognize that trying to manage individual elements of the landscape is not effective and that natural disturbances are part of the dynamics of ecosystems.

New policy is required to provide the rationale for basic forest protection programs, as well as the rationale for when natural disturbance regimes should be left to carry out their ecological functions. The justification must reflect the values held by the public, northern residents and forest stakeholders. An integral component of this work has been extensive public consultations over the past three years. SERM is currently finalizing new provincial policies to guide Saskatchewan's wildfire and forest insect and disease management activities. Work is progressing in developing an action plan to describe how the policy will be implemented over the next few years. The fire protection program will focus on two key priority areas: implementing a "values at risk" approach and incentives to reduce risk from wildfire. Protection of human life has been, and will remain, the highest priority.

Steep granite hills are characteristic of the lands south of Tazin Lake. Driftwood decomposes very slowly in the cold, dry climate. Robert A. Wright

5.8 Environmental Monitoring

In 1999, the Shield EcoRegion (a SERM administrative region) initiated SERM's Ecological Effects Monitoring program with a pilot project in the Boreal Shield/Taiga Shield ecozones. Data collected from study sites included water and sediment chemistry, hydrological observations and shoreline assessments. Procedures and strategies developed during this pilot project will be applied to Ecological Effects Monitoring in other regions in the future.

One representative lake from each of the two ecoregions making up the Taiga Shield Ecozone is being monitored on a regular basis as part of an ongoing ecosystem monitoring program. Tazin Lake, located at 59° 49' latitude and 109° 05' longitude (map 74 N/14) is representative of the Tazin Lake Upland Ecoregion, while Misaw Lake, located at 59° 52' latitude and 102° 30' longitude (map 64 M/15), was chosen to represent the Selwyn Lake Upland Ecoregion. During 1999, water and sediment samples were collected in the last week of June and the first week of July. The collected samples were then preserved and shipped to the Saskatchewan Research Council and the Provincial Laboratory for analysis. Additional details on the specific sampling locations, methods and preservation techniques can be obtained by contacting the Shield EcoRegion, SERM in La Ronge. See Table 10 for water quality data and Table 11 for sediment quality data.

Tazin Lake has a surface area in excess of 33,400 ha, with a shoreline development index (ratio of the length of the shoreline to the circumference of a

Table 10 Taiga Shield Water Quality

Analyte	*Tazin Lake (Station EM1Taz)* 1999	*Misaw Lake (Station EM4Mis)* 1999	*Beartooth Is., Lake Athabasca (Station EH18Bear)* 1996	*Black Lake outlet to Fond du Lac R.(Station EH14Black)* 1996	*Wollaston Lake outlet to Fond du Lac R.(Station EH10FdlWol)* 1995
Secchi disc (m)	3.7	5.5 (at Station Mis2)	3.4	3.4	na
pH (field)	7.1	7.1	7.9	7.3	7.3
Dissolved Oxygen (field) (mg/L)	9.5	9.1	11.9	10.7	na
Conductivity (field) (µS/cm)	29	33	67	35	28
Nitrate (mg/L)	<1	<1	<0.01	<0.01	na
Sulphate (mg/L)	<10	<10	3.1	0.7	3.4
Total Alkalinity (mg/L $CaCO_3$)	14	16	na	na	na
Bicarbonate (mg/L)	17	20	31	15	na
Magnesium (mg/L)	1.1	1.8	2.1	1.2	1.1
Calcium (mg/L)	4.4	5.2	7	3	2.8
Total Hardness (mg/L $CaCO_3$)	14	12	26	12	12
Chloride (mg/L)	<2	<2	3.3	3.8	na
Potassium (mg/L)	0.6	0.6	0.2	0.5	0.5
TDS (Total Dissolved Solids) (mg/L)	23	26	na	na	na
Phosphorous (mg/L)	<0.01	<0.01	0.02	0.01	0.5
Selenium (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic (mg/L)	<0.5	<0.5	<0.5	<0.5	<0.5
Barium (mg/L)	0.005	0.1	0.012	0.004	0.004
Cadmium (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001
Chromium (mg/L)	<0.001	<0.001	0.004	0.005	0.004
Copper (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001
Iron (mg/L)	0.072	0.033	0.032	0.049	0.039
Molybdenum (mg/L)	0.003	<0.001	<0.001	<0.001	0.052
Silver (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001
Sodium (mg/L)	1.4	0.7	2.5	1.7	1.4
Nickel (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001
Lead (mg/L)	<0.002	<0.002	<0.002	<0.002	<0.005
Zinc (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005

Source: SERM

Table 11 **Taiga Shield Sediment Quality**

Analyte	Tazin Lake (Station EM1Taz) 1999 Composite - 0-2 cm	Misaw Lake (Station EM4Mis) 1999 Composite - 0-2cm	Beartooth Is., Lake Athabasca (Station EH18Bear) 1996 Mean of 3 samples	Black Lake outlet to Fond du Lac R. (Station EH14Black) 1996 Mean of 3 samples	Wollaston Lake outlet to Fond du Lac R. (Station EH10FdWol) 1995 Mean of 3 samples
pH (laboratory)	4.7	5.17	na	na	na
Conductivity (laberatory) (µS/cm)	1,540	1,600	na	na	na
SAR (sodium absorption ratio)	0.2	0.12	na	na	na
CEC (cation exchange capacity) (Meq/100 g)	55	41	na	na	na
Loss on ignition (%)	21.5	16.5	2.04	9.24	10.74
Calcium (µg/g)	7,000	5,500	3,670	3,530	2,000
Magnesium (µg/g)	2,200	2,000	7,130	3,270	1,090
Sodium (µg/g)	570	250	470	233	101
Potassium (µg/g)	1,200	1,100	5,000	1,470	777
Chloride (µg/g)	20	22	na	na	na
Sulfate (µg/g)	269	375	na	na	na
Sulfur (%)	0.16	0.17	na	na	na
Organic carbon (%)	11.1	7.76	na	na	na
Total Kjeldahl nitrogen (µg/g)	6,810	6,000	na	na	na
Boron (µg/g)	4	3	30	<10	16
Mercury (µg/g)	<0.05	0.06	na	na	na
Phosphorous (µg/g)	990	580	570	1,090	2,900
Silver (µg/g)	<0.5	<0.5	<1	<1	<1
Arsenic (µg/g)	2	2	2.1	4.2	7.1
Barium (µg/g)	110	67	120	783	48
Cadmium (µg/g)	0.8	0.5	<1	<1	1
Chromium (µg/g)	45	38	40	25	38
Copper (µg/g)	9.4	10	8.7	8	1.7
Iron (µg/g)	19,600	10,700	20,470	43,400	95,000
Molybdenum (µg/g)	1.8	2.5	<4	<4	14
Nickel (µg/g)	9.5	8.1	16	16	8
Lead (µg/g)	5	4	13	12	10
Selenium (µg/g)	<0.5	<0.5	na	na	na
Zinc (µg/g)	33	58	36	40	92

Source: SERM

circle having the same area as the lake) of approximately 2.7. The maximum fetch (the maximum length on the lake surface between any two points on the shore line) is approximately 35.5 km, and the maximum width (the maximum distance between the shores perpendicular to the line of maximum length) is approximately 13 km. Foreshore slopes are typically steep, with the same degree of slope extending into the water, resulting in limited habitat for aquatic vegetation. However, extensive sand shoals and beaches are present, especially along wind-exposed, north- and west-facing shores. Bedrock outcrops at the shoreline are common. Visible substrate is generally rock, varying from boulder to gravel size. Depths of up to 123 m were recorded northwest of Laird Island in 1999.

Tazin Lake's shoreline shows the effects of water level regulation by the dam at the Tazin River outlet. Higher water levels in the past resulted in extensive flooding of shoreline timber. Present water levels, of about 2 m lower than peak levels, have exposed the dead trees, now bleached and dried by sun and weather.

Misaw Lake has an area of 9,800 ha, with a higher shoreline development index of about 3.4, due to its roughly horseshoe shape. The maximum fetch is approximately 10.5 km, and the maximum width is about 9.5 km. The shoreline relief is much less dramatic than at Tazin Lake, with short foreshore slopes 2-5 m higher than the water level, with relatively flat terrain behind. Though depths of over 20 m were noted in 1999, most of the lake is much shallower. There are extensive beds of aquatic vegetation, and numerous rock shoals, both above and just below the surface, located throughout the lake. Visible substrate varies from boulder to gravel-sized rock.

5.9 Culture and Heritage Initiatives

Enhancing relationships with Aboriginal groups and involving them in decision-making in the resource sector contributes to self-sufficiency and self-determination for Aboriginal people, as well as supporting sustainable renewable resource management.

5.9.1 *Aboriginal Policy*

The *SERM Aboriginal Affairs Policy Framework – A Tool for Decision Making* focuses on achieving sustainable environment and resource management through the direct and meaningful involvement of Aboriginal people. The development of various arrangements and strategies, as well as the transfer of this policy and its implementation into SERM's day to day activities, follow a set of principles as found in the framework:

- ministerial authority and department responsibility to protect the environment and manage renewable resources sustainably for all Saskatchewan residents;
- recognition of, and respect for, the legally defined rights of Aboriginal people;
- priority allocations to First Nations people, after conservation needs are met, in the use of fish and wildlife for food;
- respect for Aboriginal tradition, knowledge, culture and values both in the workplace and in the field;
- involvement of Aboriginal peoples in department policy, program planning and environmental assessment initiatives, where appropriate;
- maximizing capacity, self-reliance and self-determination of Aboriginal people when possible;
- federal jurisdiction and responsibility for Aboriginal peoples, including status Indians and lands reserved for Indians, non-status Indians and Métis people; and
- no prejudice to current and future interpretations of Aboriginal Constitutional rights, land claims or other legal entitlements.

SERM currently has a number of co-management arrangements which include First Nations and Métis representatives, along with outfitters, trappers, the forest industry and other resource users. An enhanced decision-making model for co-management groups is also being examined. Work is in progress with First Nations and Métis groups to develop a framework for the use of traditional knowledge, innovations and practices in the management of resources.

Several bi-lateral partnerships exist with several Aboriginal groups. At the provincial level, in 1994, SERM entered into a Renewable Resources and Environmental Protocol Agreement with the Federation of Saskatchewan Indian Nations (FSIN) and, in 1995, a Renewable Resources and Environmental Management Partnership Agreement with the MNS. These agreements were established to develop and enhance positive working relationships and to develop a framework to establish First Nation and Métis involvement and capacity in environmental and resource management. Recent outcomes from these agreements include:

- In 1999, a Services Agreement with FSIN was signed. This agreement has led to numerous achievements, including the FSIN/SERM bilateral taskforce, whose role is to establish priorities for a joint work plan, issue identification and resolution, consultation and communication at the senior management and chief level. Also, the program places FSIN policy analysts along-side SERM staff in the workplace and increases the FSIN component of field staff who work with First Nations and SERM at the regional level.
- The partnership agreement with the MNS has led to numerous achievements, including the MNS/SERM bilateral task force that implements a co-operative joint practical work plan, to address

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THE BEVERLY-QAMANIRJUAQ CARIBOU MANAGEMENT BOARD (BQCMB) – A MODEL FOR CO-MANAGEMENT

Caribou populations of the mainland Arctic declined dramatically during the 1960s and 1970s. In 1985, an unusually high winter harvest of Beverly caribou in northern Saskatchewan was thought to place that herd in jeopardy and focused concerns of both wildlife managers and traditional users. It became clear that stepping up the control measures on parts of the caribou range would not be enough to reverse this trend. A co-ordinated, multi-jurisdictional effort was required.

In December 1986, federal, provincial and territorial ministers met and agreed that co-operative action was needed. After a series of consultations, the Beverly and Qamanirjuaq Caribou Management Board was formed in 1982, to help manage two caribou herds whose migratory routes straddle five provinces, two territories and four different Aboriginal cultures. The board acts as the overall co-ordinating body, integrating aspects of decision-making, herd monitoring, scientific and traditional knowledge, and public education.

Aboriginal people and government representatives have become full partners in managing the caribou resource. Originally there were eight individuals representing the Aboriginal people and five individuals representing the governments of Canada, Saskatchewan, Manitoba and the NWT. Today the board has 12 members - four who represent the governments of Saskatchewan, Manitoba, NWT and Nunavut, and eight who represent Aboriginal communities. In both cases, the majority of board members have been represented by the Aboriginal communities. The BQCMB was the first co-management board for a major game species in North America and has been used as the model for similar boards in Canada.

The BQCMB meets twice a year. One meeting is held in a community within the caribou range to give the residents a voice in the herd

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environmental and resource management issues of mutual concern; and a services agreement which supported the hiring of a MNS lands and resources coordinator to support capacity building in the partnership agreement and task force.

SERM has established a workplace diversity consultant position to develop, implement and evaluate a workplace diversification program, including an Aboriginal employment strategy, cultural awareness strategy and employment equity coordination. The workplace diversity program has enabled SERM to exceed the Saskatchewan Human Rights Commission target for Aboriginal representation within the department.

5.9.2 Northern Strategy

The Northern Strategy, a common approach to economic and social development in northern Saskatchewan, adopted by the province with First Nations, the Métis Nation and northern municipalities, places emphasis on the need for sustainable development and environmental protection. An Interim Northern Development Board is seeking federal government agreement to participate in a Northern Development Accord that will generate initiatives in support of the strategy's goals and objectives:

- developing a stronger and more diversified economy;
- enhancing community and regional infrastructure that will assist economic development and improve northern living conditions;
- strengthening education and training in the north;
- increasing community self-reliance and enhancing northerners' opportunities to participate in, and provide leadership for, northern institutions; and
- increasing northerners' participation in the protection of the natural environment.

The Northern Strategy and its sponsoring agencies seek expansion of the northern economy to achieve increased self-reliance by northern families and communities. However, consistent with northern cultures and traditions, priority is given to ensuring that new developments, such as roads and expanded commercial forestry, respect the need for ecosystem sustainability.

5.9.3 Heritage Property Protection

The Heritage Property Act provides for the protection, conservation and development of Saskatchewan's cultural heritage sites. To this end, all significant land development in the Taiga Shield Ecozone is reviewed to ensure that heritage sites are documented, potential impacts assessed, and any measures necessary to mitigate impacts are taken prior to development. Mitigation measures typically involve site avoidance through project relocation or redesign, active physical protection, or controlled data recovery and analysis. Local First Nations will be consulted to further our understanding of the human history of the Taiga Shield Ecozone, and to ensure that sacred sites are properly protected and managed.

5.10 Public Involvement

Public involvement is essential for effective environmental protection and sustainable resource management. In 1994, SERM developed a public involvement policy framework and guidelines. This framework formalizes the department's policy of using a variety of public involvement methods to assist its resource management decision-making. The document clearly outlines the context, vision, principles and guidelines for SERM's public involvement activities. The public involvement methods most

often used by SERM are consultation, partnerships and co-management.

5.10.1 Consultation

Consultation is a dialogue where SERM engages other parties in a discussion of an issue or policy to achieve a common understanding and receive input and advice toward an acceptable solution.

In response to widespread public complaints about the practice of night hunting, SERM entered into province-wide consultation talks with the FSIN, individual First Nations bands and other Aboriginal groups in the winter of 1997-98. The result of these consultations was the implementation of new regulations that prohibit the discharge of a firearm from a road at night and the use of artificial light to assist hunting. During the consultations SERM was made aware of the traditional northern practice of hunting big game at night using natural moon light. The advice of this traditional practice combined with the relatively few safety-related concerns in the Taiga Shield Ecozone resulted in the modification of the regulations to accommodate this long-standing hunting method.

5.10.2 Partnerships

Partnerships can be a formal written agreement or an informal working relationship. In either case, they are a means to improve and build a relationship between SERM and another party or parties toward achieving a common goal.

In 1995, SERM signed a partnership agreement with the Hatchet Lake First Nation. This Integrated Resource Management Agreement solidifies SERM's relationship with the Hatchet Lake First Nation to work together on renewable resource management issues within the band's traditional area, which is largely within the Taiga Shield Ecozone.

5.10.3 Co-management

Co-management is the process through which there is broad representation from the full range of renewable resource user interests participating in resource management decision-making. These initiatives are conducted over a specified geographic area and utilize local knowledge to support the decisions made. They can be formalized with written agreements but are more commonly informal yet structured arrangements.

The Taiga Shield Ecozone is home to one of the most long-standing co-management boards in the province. The Beverly and Qamanirjuaq Barren Ground Caribou Management Board was established in 1981. The board is made up of Inuit, Métis and Dene people of the area and territorial and provincial government staff. They look at issues of allocation, harvest pressure and habitat protection with a view to long-term management of these migratory barren-ground caribou herds in the northeast corner of Saskatchewan.

The Wollaston Lake Co-management Board meets annually to discuss issues related to the management of Wollaston Lake. The board comprises outfitters, commercial fishermen, First Nations, sport anglers, mining company representatives and SERM.

Barren-ground caribou

BCCMB (continued)

management; the other is held in a more central location. Although, the BCCMB is an advisory board, governments have generally followed its advice on herd management. Decisions made by the BCCMB are generally based on consensus, and the board is seen to work as a team with common objectives.

Some achievements of the BCCMB include the following (Board publications are made available in English, Inuktitut and Dene languages):

- *the development of two 10-year Beverly and Qamanirjuaq Caribou Management Plans;*
- *a multi-year project that identified areas of land and water especially important to the two herds of caribou, resulting in a 52-page report, Protecting Beverly and Qamanirjuaq Caribou and Caribou Range, and subsequent CD-ROM of map data;*
- *the establishment of categories of priority use to determine allowable harvest of caribou;*
- *fire management studies – the collection of traditional knowledge to map out priority hunting area on the range, leading to the publication of Fire Management Technical Report No. 1, in 1998;*
- *the development of a four-volume kit for a barren-ground caribou school program;*
- *the establishment of a scholarship fund for students studying the management and conservation of barren-ground caribou and their habitat; and*
- *the creation of Caribou News and later Caribou News in Brief, a newsletter to improve communications on a wide array of issues.*

Of all the strides made throughout the board's history, one of the most important is the improved level of trust and respect among the different Aboriginal and government groups that these meetings have fostered. Before, different cultures and knowledge systems collided, resulting in uneasy relations. All sides have made tremendous efforts to find common ground, in order to conserve caribou for the use of future generations.

More information about BCCMB can be found on their web site at: http://www.arctic-caribou.com/

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VI Summary

Saskatchewan's State of the Environment Report 2001 – The Taiga Shield Ecozone: Land of the Caribou highlights the most northern ecozone in Saskatchewan. It is a land which is unknown to most Saskatchewan residents and is largely populated by Aboriginal people who still have a close working relationship with the land. A few non-Aboriginal residents are primarily involved in administering health, education and social services. Total population of the ecozone is about 1,300 of which approximately 40% are under the age of 15 years.

The Taiga Shield Ecozone is characterized by a rocky, forested landscape interspersed with many lakes, bogs, marshes and fens. Because of the harsh growing conditions characterized by long winters, short summers, relatively little precipitation and shallow soils, the vegetation and animal life is sparse compared to areas farther south. This unproductive nature of the land has precluded agricultural opportunities, and the small tree size, slow growth and distance from markets have restricted forestry activities to local harvests for fuel and basic building materials.

Most people now live in one of three Indian reserves or four settlement communities in the ecozone. These communities were established in the early part of the 20th century on major rivers and along traditional caribou migration routes. The people of Aboriginal descent still engage in hunting (particularly barren-ground caribou), trapping and domestic fishing, as well as gathering wild fruits and plants. These sources of sustenance are supplemented by a few jobs provided farther south in the mining industry. Some employment is also provided in the service industries and by a number of remotely located outfitting lodges. Commercial fishing has not been sustainable because of long distances from markets and relatively low productivity of the oligotrophic lakes.

Whether employed at a salaried job or not, most residents traditionally pursue the barren-ground caribou, which migrate south each winter into the region. The ancient tradition of the Dene people was to follow the caribou all year. The caribou which traveled in vast herds of several thousand strong, supplied virtually all material needs: food, clothing, tools, weapons, thread and tents. In the 18th and 19th centuries, the followers of the caribou were encouraged to settle near fur trading posts along the major rivers and lakes, to hunt and trap for furs and trade them for European goods. A significant number of Métis people, who are the descendants of Aboriginal and European workers in the fur trade, also settled near the old fur trading posts and have remained as residents.

As part of the signing of Treaty 8 in 1889 and Treaty 10 in 1907, several Indian reserves were created in the Taiga Shield Ecozone to accommodate the Fond du Lac, Black Lake and Hatchet Lake First Nations. In addition there are four small communities within the ecozone: Uranium City, Camsell Portage, Fond-du-Lac and Wollaston Lake, the later two of which are in, or partly in, Indian reserves. Uranium City developed as a major service centre for a number of mines which sprang up north of Lake Athabasca in the mid-1900s. Now the mines in the ecozone have all been closed and Uranium City has been reduced to a fraction of its former population.

Because this ecozone is located at the edge of the boreal forest and the tundra, it supports some species which are common to the boreal forest, while others are typical of the arctic tundra. Thus, typical tundra species such as barren-ground caribou, snowy owl and willow ptarmigan wander into the ecozone, particularly during the winter. Species such as wood warblers, spruce grouse and beaver are more common in the more heavily treed boreal forest habitats to the south, but are scattered throughout the Taiga Shield Ecozone. Although commercial tree species such as jack pine, black and white spruce, paper birch and tamarack occur, growth is very slow and most trees never attain more than 12 cm in diameter. A number of plant species found in this ecozone are considered rare or uncommon to Saskatchewan. No animal species have been classified as endangered, but the shortjaw cisco, a small deep-water fish more commonly found in eastern North America is classified as threatened. The wolverine, because of its very low numbers and inability to sustain populations near human activities, is identified as being of special concern.

There are some local environmental concerns in this ecozone, even though it is relatively pristine. Mines, which were mostly closed in the 1950s and early 1960s, were decomissioned at a time when environmental regulations were less rigorous. Now, the objective is to bring their decommissioned status up to present-day regulations. Localized water pollution can result from improper disposal of domestic sewage. Most potable water for the communities in this ecozone comes from the extensive surface water supplies of lakes, rivers and shallow wells. The larger communities have water and sewer systems which supply domestic water and sewage treatment. Smaller communities still use outhouses and carry their water from a local lake or river. The communities of Fond-du-Lac and Wollaston Lake are experiencing population growth and will require water system upgrades in the near future. Landfills are being developed for some of the larger communities to address solid waste (garbage) disposal problems.

This area of the province has historically been isolated for much of the year. Winter roads from the south and barge traffic from Fort McMurray, combined with scheduled and unscheduled small aircraft transportation, provided the only transportation of goods and supplies. Residents use small water craft to travel on the rivers and lakes in summer and

snowmobiles, dog teams and snowshoes to travel in the winter. Recent construction of the Athabasca Seasonal Road will increase accessibility of the area but may present some environmental challenges. Increased hunting and trapping pressure on wildlife and fragmentation of some of the plant communities and aquatic systems may result if sufficient care is not taken to maintain existing ecological processes and functions.

Snow machine trail through a dense black spruce stand - a common plant community type on poorly drained lowlands. Robert A. Wright

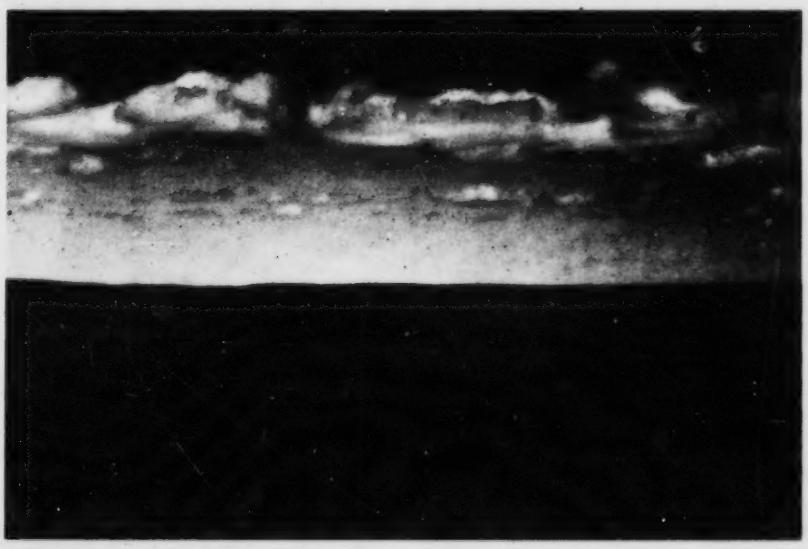
Like other areas, the Taiga Shield Ecozone is being influenced by outside forces. Acid precipitation from the petroleum industry in Alberta has the potential to further reduce diversity and productivity of plant life through acidification of lakes and soils. The effects of climate change, resulting in the melting of bogs and muskegs at critical times of caribou migration, could remove this vital resource from reach of the residents of the area. Climate change could also increase frequency of forest fires and violent weather.

Management of the environment today is based on an ecosystem-based approach, which integrates management of natural landscapes, ecological processes, physical and biological components and human activities to maintain ecological health and integrity in the ecosystem. One tool for managing in this way is integrated land use plans (ILUPs), which provide a framework for resource management decisions and involves a variety of stakeholders in the process. An ILUP which affects the Taiga Shield Ecozone is the Agreement Respecting the Land and Renewable Resource Use Planning and Management in Northern Saskatchewan - Lake Athabasca Region, which involves SERM, other government departments, First Nations, various communities and the public to ensure that all uses and values of the ecosystem are considered.

The Representative Areas Network (RAN) is another tool, designed to protect biological diversity by selecting and designating areas representative of Saskatchewan's natural ecological diversity. In SERM's efforts to monitor environmental health and ecological integrity, the RAN provides a benchmark on which to base assessments of human impacts on other similar landscapes and ecosystems. Three new representative areas are under discussion for the Taiga Shield Ecozone.

A model of a successful co-management approach to managing a major game species is the Beverly-Qamanirjuaq Caribou Management Board (BQCMB), a resource management team of representatives of the traditional users and governments. The BQCMB has been functioning successfully since 1982 to help manage two barren-ground caribou herds whose migratory route straddles two provinces, two territories and four different Aboriginal cultures.

Because the people of this ecozone are so spiritually, culturally and economically tied to the land, to the clean water, to healthy plant communities and sustainable animal populations, protection of the natural environment takes on more immediate and apparent significance than in other more developed areas of the province. Although the Taiga Shield Ecozone is still a relatively pristine environment, it is necessary to monitor the fragile ecosystems, to ensure their health and integrity through changes in accessibility, climate, development and societal values.



Open black spruce forest on rocky islands in Misaw Lake. Robert A. Wright

Since 1995, the SOE report has discussed one of the four ecozones of Saskatchewan. This 2001 report on the Taiga Shield Ecozone is the final report in that series. The 2003 report will set the stage and introduce a new methodology for Saskatchewan's SOE reporting.

If you have any questions or comments on the contents of this report, or suggestions on how such SOE reports could better serve your needs, please write us at:

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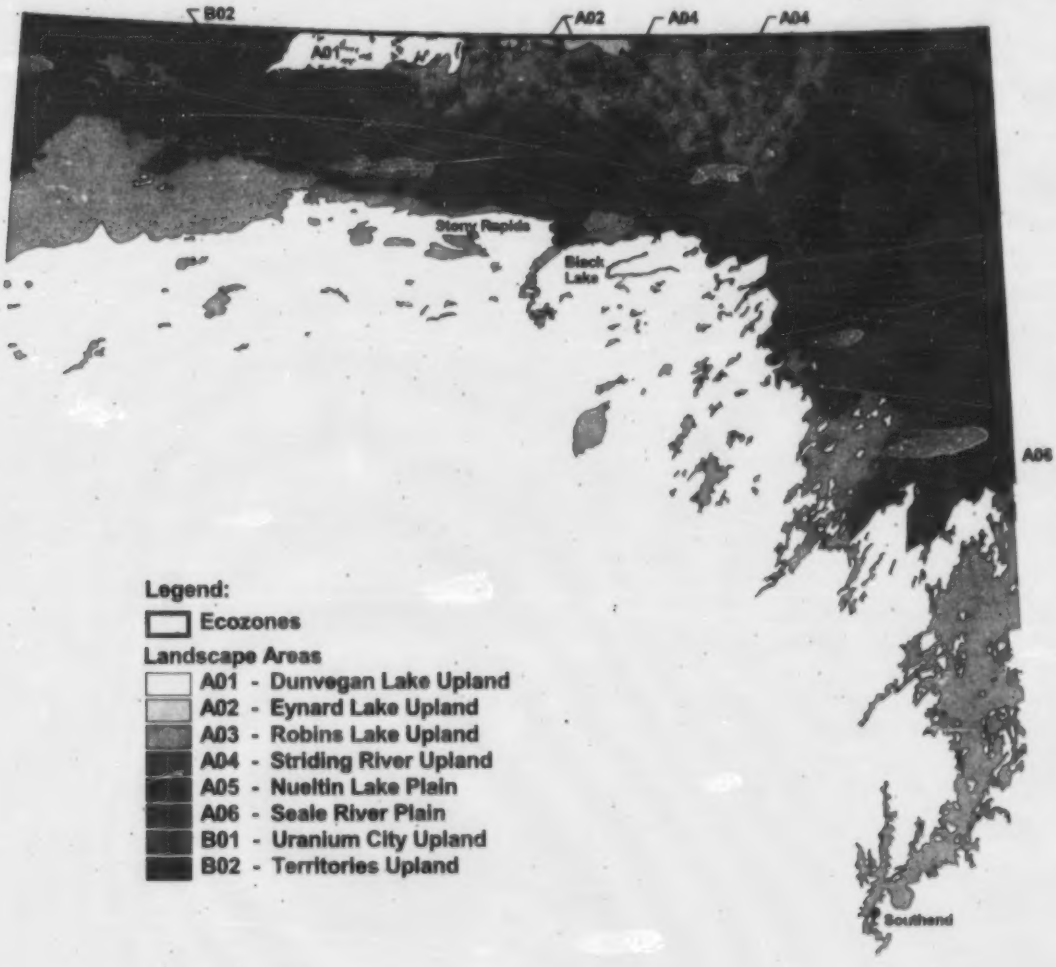
This report is posted in PDF format on SERM's web site: www.serm.gov.sk.ca. Internet addresses cited in the report are current as of January 2001.

Nutrient-poor and very rugged, rocky uplands in the Tazin Lake Upland Ecoregion. Open forests of stunted jack pine and black spruce dominate these granite hills. Robert A. Wright

Appendix 1

Landscape Areas within the Taiga Shield Ecozone



SELWYN LAKE UPLAND ECOREGION (MAP CODES A1-A6)

Dunvegan Lake Upland

This is a small area in Saskatchewan but much more extensive in the Northwest Territories (NWT). It is an area with broad slopes representing rugged crystalline basement rocks that are largely covered with glacial drift. Elevations range from approximately 420 m at Picae Lake and many smaller lakes that prevail in the area to 500 m on local promontories. The western part of the area drains through the Tazin River to Tazin Lake.

Brunisolic soils formed in a discontinuous blanket of sandy and bouldery glacial till are the dominant soils in the area. Gentle to moderate slopes predominate in this area as the glacial till is sufficiently thick to obscure the underlying bedrock, except for local rises. In local areas, the cover of glacial till is discontinuous and bedrock outcrops dominate a steeply sloping landscape. Eskers and drumlins are prominent landscape features, locally. Small bogs and fens occur in low-lying depressions and surrounding lakes where gleyed brunisolic, gleysolic and cryosolic soils prevail.

Due to the deep glacial drift and better soil moisture conditions, the opportunity for fire to start and to spread is reduced. Therefore, this area seems to have suffered less extensive fires than the rest of the Selwyn Lake Upland. On the well-drained morainal uplands, lichen woodland is strongly developed, with foam lichens particularly prominent in the reflectant groundcover. Black spruce, jack pine and white birch dominate the woodland mosaic, while extensive peat plateaus mantle the lowlands.

Eynard Lake Upland

This is a small area in Saskatchewan but much more extensive in the NWT. It is an area with broad slopes representing rugged basement rocks that are largely covered with glacial drift. Elevations range from approximately 450 m at Sovereign Lake, and many smaller lakes that prevail in the area, to 480 m on local promontories.

The area is dominated by brunisolic soils formed in a discontinuous blanket of sandy and bouldery glacial till and outwash. In some areas the glacial till is sufficiently thick to mask the underlying bedrock, except for local rises, and moderate slopes prevail. Eskers and drumlins are prominent landscape features, locally. Small bogs and fens occur in low-lying depressions and surrounding lakes where gleyed brunisolic, gleysolic and cryosolic soils prevail.

Open lichen woodland is the prevalent vegetation on both glacial till and outwash plains. In drumlinized areas, peatlands often comprise 40-50% of the landscape cover.

Robins Lake Upland

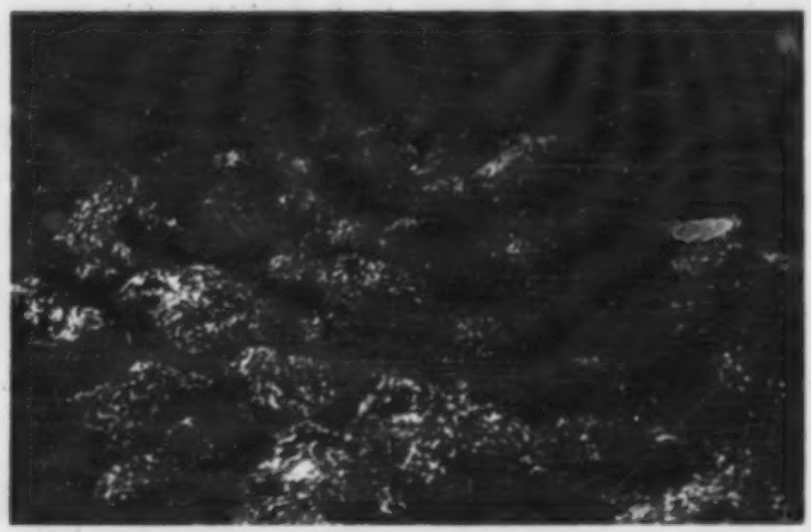
This is a large area with broad steep slopes representing rugged basement Precambrian rocks with only a discontinuous cover of glacial drift. Elevations range from approximately 450 m at Scott and Premier lakes to over 500 m in local promontories in the northwestern part of the area, and from 400 m at Herbert and Milton lakes to 450 m on local rises in the eastern part of the area. There is drainage to the south from these and many other lakes in the area through the Grease and the Porcupine rivers and many small creeks.

The area is dominated by steep ridges of bedrock. Brunisolic soils form in a thin veneer of sandy and bouldery glacial till that is scattered between bedrock outcrops and on prominent sandy, gravelly eskers. Patterned rock fields formed by frost action, called felsenmere, are a common occurrence where bedrock crops out, as are small bogs and fens in low-lying areas.

While very open lichen woodland and rock lichen is common on the rougher bedrock landscapes, the existence of open lichen woodland on subdued landscapes in this landscape area is indicative of the subarctic climate. The presence of lichen-covered, polygonal peat plateaus and palsas further attests to the harshness of the climate in this area.

Striding River Upland

This area is fragmented into two small parts in Saskatchewan by the border with



Felsenmeer (frost-churned block field) on the gentle western slope of Arctic Butte east of Misaw Lake. Felsenmeer is formed by cryoturbation (slow churning of the stones by the alternate freezing and thawing of the soil) that separates the stones from the fine-textured materials in the underlying soil. Note the luxuriant growth of crustose lichens. Robert A. Wright

the NWT. It is a broadly sloping area dominated by rugged basement rocks that are largely covered with glacial drift. There are numerous large, shallow lakes oriented in a northeast to southwest direction, which reflect the bedrock structure. Elevations range from approximately 450 m in the western part of the area to 400 m in the east. The Striding River drains part of this area into Wignes Lake in the NWT.

Brunisolic soils formed in a discontinuous blanket of sandy and bouldery glacial till are the dominant soils in the area. In some areas the till is sufficiently thick to obscure the underlying bedrock, except for local rises, and moderate slopes prevail. Eskers and drumlins are prominent landscape features, locally. Felsenmere is commonplace in association with bedrock outcrops. Strandlines of former glacial lakes have been cut into the glacial sediments in uplands at higher elevations. A large, flat bog occurs near Waptya Lake, and small bogs and fens occur in numerous low-lying areas and surrounding lakes. Organic soils are present in some of the fens, but most of the fens and bogs are cryosolics.

The western edge of this landscape area follows the "bog treeline," meaning that the peat plateaus are generally treeless in the Striding River Upland. The lowland terrain is extensive, and the treeless polygonal peat plateaus frequently show signs of erosion. The glacial till veneer supports open lichen woodland on well-drained sites. Where the glacial till is quite sandy and bouldery, the lichen woodland stand becomes very open.

Nueltin Lake Plain

This is a very large area in the northeast corner of the province. Elevations of this broadly sloping area range from 420 to 450 m, occasionally 480 m, in areas to the north and south of Phelps Lake and northeast of Wollaston Lake. They recede to approximately 350 m at Hasbala Lake and Zangeza Bay of Reindeer Lake, on the Manitoba border. The southern part of

Pond in a collapsing peat plateau adjacent to shore of Misaw Lake. Black spruce trees are growing on an adjacent palsa of still-frozen permafrost. Note trees drowned by collapse of peat as permafrost melted and pond formed in the collapsed area. Robert A. Wright

the area is part of the Wollaston Lake basin. It drains to Wollaston Lake, which drains northward through the Cochrane River to Hudson Bay, as well as through the Fond du Lac River to Lake Athabasca and the Beaufort Sea. The western part, including Hatchet, Phelps and Hannah lakes also drains to Lake Athabasca. The extreme northeastern part, including Patterson and Misaw lakes, drains northward into the NWT, and the eastern part, including Charcoal and Hara lakes, drains eastward into Manitoba.

The area is dominated by brunisolic soils formed in a blanket of sandy and bouldery glacial till and on the many, prominent sandy and gravelly eskers that occur in the area. The ground moraine is thicker and more continuous in this area than many other areas in this ecoregion. In addition, hummocky moraines and drumlins add to the mantle of materials that subdues the underlying bedrock topography. There are numerous bogs and fens in this area, some of them very large. In the southern part, organic soils are commonly associated with these peatlands, but cryosolics are associated with peat plateaus on permanently frozen deposits further north. Pools of water on the margins of peat plateaus in the fens, called thermokarst, are further evidence of frozen soils in this area.

Black spruce, somewhat smaller than in forests to the south and west, occupies a variety of habitats from dry esker ridges to wet bogs and stream margins. Individuals of jack pine, white birch and tamarack may be associated with the black spruce, but pure stands of these other species are uncommon. Open lichen woodland occupies the tops and slopes of eskers, till ridges, old beach ridges and outcrops covered with shallow soil. On lower, well-drained slopes, feather mosses dominate the forest floor; the black spruce form a more-closed canopy; and shrubs like dwarf birch, green alder and beaked willow are scattered through the understory. Bogs may be treed, but are usually treeless. If treed, the black spruce are closely spaced. Bare silt frost boils are sometimes observed in intermittent drainage channels between sphagnum hummocks. These boils contain rush and sedge species common to an arctic ecosystem. Rocky lake margins also harbour arctic species. Some tundra areas are found on high rocky elevations, or in moist boulder fields; here, dwarf birch, mats of prostrate willows, sedges and ericaceous shrubs are common.

Seale River Plain

This is a small area along the Manitoba border, east of Wollaston Lake. Elevations of this broadly sloping area range from 400 to 450 m. They diminish to approximately 350 m at Zangeza Bay of Reindeer Lake, on the Manitoba border. The southern part of the area drains southward to Zangeza Bay and the northern part drains eastward to the Brochet River in Manitoba.

The area is dominated by brunisolic soils formed in a moderately sloping blanket of sandy and bouldery glacial till. Cryosolic soils occur in lower slope

positions in these glacial materials. Sedge bogs are numerous and many of them contain permafrost.

The sandy blanket of glacial materials on uplands is covered with an open lichen forest, while rock lichens coat exposed bedrock. The numerous, permanently frozen bogs are usually treeless and lichen covered.

TAZIN LAKE UPLAND ECOREGION (MAP CODES B1-B2)

Uranium City Upland

This is a large area lying to the north of Lake Athabasca, Fond du Lac River and Black Lake. Broad slopes representing rugged crystalline basement rocks are sparsely covered with glacial drift. The topography is very rugged, with local relief often approaching 100 m. Elevations range from less than 300 m on the large lakes along the southern margin to approximately 500 m in the northern part of the area. The Oldman, Bulyea, Grease and Porcupine rivers and numerous other rivers and creeks provide drainage to Lake Athabasca, the Fond du Lac River and Black Lake.

The area is dominated by steep bedrock ridges. Brunisolic soils form in a thin veneer of sandy and bouldery glacial till scattered between the bedrock outcrops. Organic and cryosolic soils occur on numerous, small, low-lying and poorly drained areas.

Sheer granite rock faces are colonized by slow-growing crustose lichens in the rugged shield country south of Tazin Lake (Carman Dodge, Forest Ecosystem Classification Project). Robert A. Wright

Because there is so little drift, the surface-dry upland terrain is very susceptible to lightning fires; even-aged forests of jack pine are, therefore, prominent, along with the widespread black spruce. White spruce occurs on margins of some fens and marshes, and trembling aspen occupies low, sheltered areas.

Territories Upland

This is a small area, in Saskatchewan, along the border with the NWT, but it is much more extensive in the territories. Broad slopes representing rugged basement rocks are largely covered with glacial drift. Elevations range from approximately 420 m at Ena and many smaller lakes that prevail in the area, to 480 m on local promontories. The Abitau River, with headwaters in the NWT, drains part of this area into Ena Lake.

The area is dominated by brunisolic soils formed in a discontinuous blanket of sandy and bouldery glacial till. The till is generally sufficiently thick to mask the underlying bedrock, and gentle to moderate slopes predominate. Occasionally, eskers and drumlins interrupt this pattern, but they are not as common as in the Dunvegan area to the north. Organic and cryosolic soils occur in numerous, small, low-lying and poorly drained areas.

Because of sufficient drift and favorable climate, the prominent vegetation is black spruce forest on both uplands and peaty lowlands. Most exposed granitic bedrock is covered by rock lichens, although clumps of reindeer moss (*Cladina*), a shrub lichen, and *Cladonia*, club and shrub lichens, are prominent. Jack pine and black spruce grow in bedrock crevices where soil development is sufficiently thick to support plant growth.

Appendix 2

Forest Communities in the Taiga Shield Ecozone

The Taiga Shield Ecozone in Saskatchewan is composed of two ecoregions: the Selwyn Lake Upland and the Tazin Lake Upland. Ecoregions are typically distinguished by differences in climate regimes and the genesis and evolution of the area's landforms. Ecoregions can be further divided into ecodistricts (landscape areas). Ecodistricts are distinguished by differences in climate (including moisture availability), origin of landform, the shape and relief of the area, and the sequence of events that shaped the earth's surface.

In terms of management, both ecoregions and ecodistricts are at the regional or landscape level, which is best suited for planning. Broad goals or planning decisions would be defined for these area such that management (or natural) actions on the ground would take considerable time to accumulate before detection could occur at this scale (e.g., deforestation for agriculture, changes in harvest patterns). Changes detected in the landscape at these scales represent a substantial impact and can be positive or negative.

Selwyn Lake Upland Ecoregion

The largest landscape area in the Selwyn Lake Upland is the Nueltin Lake Plain, which represents 66% of the ecoregion. The topography of the Nueltin Lake Plain is flat to gently rolling and is dominated by thin veneers of ground moraine soils over bedrock. This area is also interspersed with long sinuous eskers.

Soils

Dominant soils in the region are the brunisols, organics and cryosols, although instances of regosols and gleysols may also be found. See Table A1 for the soil orders, great groups, subgroups and dominant texture associated with the upland conditions.

See Table A2 for the soil orders, great groups, subgroups and dominant texture associated with the lowland conditions.

Table A1 Soils Associated with Upland Conditions in the Selwyn Lake Upland Ecoregion

Soil Subgroup	Soil Great Group	Soil Order	Dominant Texture
Orthic	Brunisol	SifS - mS	
Eluviated	Dystric	Brunisol	SivfS - SL - LS
Orthic	Regosol	Regosol	SivfS - mS
Gleyed	Humic	Regosol	SiC
Hemic	Folisol	Organic	various, Of

Source: SERM

Table A2 Soils Associated with Lowland Conditions in the Selwyn Lake Upland Ecoregion

Soil Subgroup	Soil Great Group	Soil Order	Dominant Texture
Hydric	Mesic	Organic	Of (von Post: 3-4)
		Organic cryosol	
Rego	Humic	Gleysol	vfS - mS

Source: SERM

Vegetative Communities

Vegetation at the region scale is characteristically uniform. At the large scale, there is little variation in tree species cover types: black spruce is the dominant species while isolated pockets of hardwoods (e.g., balsam poplar and white birch) also occur along some drainage corridors. Two dominant black spruce types and one hardwood type can be defined on the basis of the data collected to date. Table A3 provides a summary of the spruce and hardwood communities.

Dwarf arctic willows (Salix sp.) among the boulders of Argus Valley, 2 km west of Hasbala Lake.
Robert A. Wright

Table A3 Spruce and Hardwood Communities in the Selwyn Lake Upland Ecoregion

Dominant Vegetation		Ancillary Vegetation	
Scientific Name	Common Name	Scientific Name	Common Name
Black Spruce/Ericaceous Shrub: Clayey - Silty fine Sandy Soil (Brunisolic/Regosolic)			
Betula nana (syn: Betula glandulosa)	Swamp birch	*Andromeda polifolia*	Bog-rosemary
Cladina mitis	Green reindeer lichen	*Betula pumila*	Swamp birch
Cladina rangiferina	Grey reindeer lichen	*Calamagrostis canadensis*	Blue-joint reed-grass
Cladina stellaris	Northern reindeer lichen	*Carex spp.*	Sedges
Empetrum nigrum	Black crowberry	*Cetraria islandica*	Iceland moss
Ledum palustre spp. decumbens	Narrow-leaved Labrador tea	*Equisetum sylvaticum*	Wood horsetail
Ledum groenlandicum	Common Labrador tea	*Geocaulon lividum*	Northern comandra
Loiseleuria procumbens	Alpine azalea	*Hylocomium splendens*	Stair step moss
Picea mariana	Black spruce	*Kalmia polifolia*	Pale laurel
Pleurozium schreberi	Red stem feather moss	*Larix laricina*	Tamarack
Sphagnum spp.	Peat mosses	*Lycopodium complanatum*	Trailing club-moss or ground-cedar
Stereocaulon tenentosum	Woolly coral	*Vaccinium oxycoccus*	Small cranberry
Vaccinium uliginosum	Bog whortleberry	*Pedicularis spp.*	Lousewort's
Vaccinium vitis-idaea	Bog cranberry	*Peltigera spp.*	Leaf lichens (e.g., freckle pelt)
Flavocetraria nivalis	Flattened snow lichen	*Petasites frigidus var. palmatus*	Palmate-leaved coltsfoot
		Rubus chamaemorus	Cloudberry
		Salix spp.	Willows
Balsam Poplar - White Birch: Moist Silty Clayey Soil (Regosolic)			
Alnus viridis (syn: Alnus crispa)	Green alder	*Calamagrostis canadensis*	Blue-joint reed-grass
Betula papyrifera	White birch	*Carex spp.*	Sedges
Populus tremuloides	Trembling aspen	*Cornus canadensis*	Bunchberry
Rubus idaeus	Red raspberry	*Chamerion angustifolium* ssp. *angustifolium*	Narrow-leaf fireweed
Phegopteris connectilis	Narrow beech fern	*Equisetum sylvaticum*	Woodland or wood horsetail
Viburnum edule	Low bush-cranberry	*Ribes triste*	Swamp red currant
		Salix spp.	Willows
		Viola spp.	Violets
Black Spruce Bog/Fen Complex: Organic/Cryosolic Soils			
Cladina mitis	Green reindeer lichen	*Alnus incana ssp. rugosa*	Speckled alder
Cladina rangiferina	Grey reindeer lichen	*Andromeda polifolia*	Bog-rosemary
Flavocetraria nivalis	Flattened snow lichen	*Arctostaphylos rubra*	Red alpine bearberry
Hylocomium splendens	Stair step moss	*Betula nana (syn: Betula glandulosa)*	Swamp birch
Kalmia polifolia	Pale laurel	*Calamagrostis canadensis*	Blue-joint reed-grass
Ledum palustre spp. decumbens	Narrow-leaved Labrador tea	*Carex sp.*	Sedges
Ledum groenlandicum	Common Labrador tea	*Chamaedaphne calyculata*	Leatherleaf
Picea mariana	Black spruce	*Cladina stellaris*	Northern reindeer lichen
Rubus chamaemorus	Cloudberry	*Cornus canadensis*	Bunchberry
Sphagnum spp.	Peat mosses	*Empetrum nigrum*	Black crowberry
Vaccinium vitis-idaea	Bog cranberry	*Equisetum scirpoides*	Dwarf scouring-rush
		Eriophorum sp.	Cotton-grasses
		Icmadophila ericetorum	Sprayppaint (crust lichen)
		Larix laricina	Tamarack
		Vaccinium oxycoccus	Small cranberry
		Peltigera sp.	Leaf lichens (e.g., freckle pelt)
		Pleurozium schreberi	Red stem feather moss
		Pyrola chlorantha	Greenish flowered wintergreen
		Ribes sp.	Currants
		Rubus chamaemorus	Cloudberry
		Salix spp.	Willows
		Maianthemum trifolium	Three-leaf Solomon's-seal
		Vaccinium caespitosum	Dwarf bilberry
		Vaccinium uliginosum	Bog whortleberry

Footnote: "syn" refers to synonyms, or older scientific names of the plant. These names may still be used in reference books.

Source: SERM

Forest Mensuration (or Measurement)

Tree growth rates in the Selwyn Lake Upland Ecoregion are quite variable, even within similar site types. Table A4 provides the height, DBH (diameter at breast height, or 1.3 m) and age for the species sampled on each of the site types.

Tazin Lake Upland Ecoregion

The largest landscape area in the Tazin Lake Upland is the Uranium City Upland, which represents 98% of the ecoregion. The topography of the Tazin Lake Upland is more variable than the eastern ecoregion. While it too has flat to rolling conditions, it also has rugged hummocky, ridged and undulating surface form.

Soils

Dominant soils in the region are the brunisols, organics/cryosols and regosols, although some gleysols were found. Table A5 describes the soil orders, great groups, subgroups and dominant texture associated with the upland conditions.

Table A6 describes the soil orders, great groups, subgroups, and dominant texture associated with the lowland conditions.

Heavy growth of arboreal (tree-dwelling) lichens on jack pine, south shore, Tazin Lake. Arboreal lichen is a critical food component in the winter diet of caribou. Robert A. Wright

Table A4 Height, Diameter and Age of Trees on the Site Types in the Selwyn Lake Upland Ecoregion

Species	Height (m)	DBH (cm)	Age (years)
Black Spruce/Ericaceous Shrub: Clayey - Silty fine Sandy Soil (Brunisols/Regosols)			
black spruce	7.7	10.7	100
black spruce	5.1	6.2	185
black spruce	5.4	8.9	140
black spruce	8.2	13.4	75
Balsam Poplar - White Birch: Moist Silty Clayey Soil (Regosols)			
balsam poplar	10.8	11.9	80
white birch	12.1	16.7	80
Black Spruce Bog/Fen Complex: Organic/Cryosolic Soils			
black spruce	6.2	9.6	130

Source: SERM

Table A5 Soils Associated with Upland Conditions in the Tazin Lake Upland Ecoregion

Soil Subgroup	Soil Great Group	Soil Order	Dominant Texture
Hemic	Folisol	Organic	various, Of
Orthic	Dystric		mS - cS
Orthic	Regosol	Regosol	SifS - SimS - LfS
Rego/Orthic	Gleysol	Gleysol	Of (von Post: 1-2)

Source: SERM

Table A6 Soils Associated with Lowland Conditions in the Tazin Lake Upland Ecoregion

Soil Subgroup	Soil Great Group	Soil Order	Dominant Texture
Typic	Mesic	Organic	Of (von Post: 4-5)
		Organic	
		Cryosol	

Source: SERM

Vegetative Communities

Like the surface forms of the region, there is also a greater variety of vegetation when compared to the Selwyn Lake Upland. The Tazin Lake Upland has greater proportions of pine, white spruce and trembling aspen than the eastern ecoregion. Eight site types can be defined on the basis of the data collected to date. Table A7 provides a summary of these communities.

Very steep granite hills on the Crackingstone Peninsula near Uranium City. Robert A. Wright

Table A7 Vegetative Communities in the Tazin Lake Upland Ecoregion

Dominant Vegetation		Ancillary Vegetation	
Scientific Name	Common Name	Scientific Name	Common Name
Jack Pine/Lichen: Dry Sandy Soil (Brunisols)			
Arctostaphylos uva-ursi	Bearberry	*Anemone* sp.	Anemones
Cladina mitis	Green reindeer lichen	*Calamagrostis canadensis*	Blue-joint reed-grass
Pinus banksiana	Jack pine	*Campanula rotundifolia*	Harebell
Vaccinium vitis-idaea	Bog cranberry	*Cladina rangiferina*	Grey reindeer lichen
		Cladina stellaris	Northern reindeer lichen
		Geocaulon lividum	Northern comandra
		Hylocomium splendens	Stair step moss
		Icmadophila ericetorum	Spraypaint (crust lichen)
		Linnaea borealis	Twinflower
		Oryzopsis pungens	Northern rice grass
		Peltigera spp.	Leaf lichens (e.g., freckle pelt)
		Pleurozium schreberi	Red stem feather moss
		Populus tremuloides	Trembling aspen
		Orthilia secunda (syn: *Pyrola secunda*)	One-sided wintergreen
		Senecio sp.	Ragworts
		Stereocaulon tomentosum	Woolly coral
Jack Pine-White Birch/Ericaceous Shrub: Loamy Fine Sand Soil (Brunisols/Regosols)			
Alnus viridis (syn: *Alnus crispa*)	Green alder	*Cladina mitis*	Green reindeer lichen
Arctostaphylos uva-ursi	Bearberry	*Cladina* sp.	Reindeer lichens
Betula papyrifera	White birch	*Dicranum* sp.	Cushion mosses
Ledum groenlandicum	Common Labrador tea	*Hylocomium splendens*	Stair step moss
Pinus banksiana	Jack pine	*Linnaea borealis*	Twinflower
Pleurozium schreberi	Red stem feather moss	*Stereocaulon* sp.	Woolly coral
Vaccinium vitis-idaea	Bog cranberry		
White Spruce-Jack Pine-White Birch/Feathermoss: Medium Sand Soil (Brunisols)			
Betula papyrifera	White birch	*Aralia nudicaulis*	Wild sarsaparilla
Hylocomium splendens	Stair step moss	*Cladina* sp.	Reindeer lichens
Picea glauca	White spruce	*Cornus canadensis*	Bunchberry
Picea mariana	Black spruce	*Geocaulon lividum*	Northern comandra
Pinus banksiana	Jack pine	*Goodyera repens*	Lesser rattlesnake plantain
Pleurozium schreberi	Red stem feather moss	*Juniperus horizontalis*	Creeping juniper
		Linnaea borealis	Twinflower
		Pyrola chlorantha	Greenish-flowered wintergreen
		Rosa acicularis	Prickly rose
		Vaccinium vitis-idaea	Bog cranberry
		Viburnum edule	Low bush-cranberry
Black Spruce/Feathermoss: Silty Medium Sands (Brunisols/Regosols)			
Alnus viridis (syn: *Alnus crispa*)	Green alder	*Cladina mitis*	Green reindeer lichen
Betula papyrifera	White birch	*Dicranum* sp.	Cushion mosses
Ledum groenlandicum	Common Labrador tea	*Hylocomium splendens*	Stair step moss
Pinus banksiana	Jack pine	*Linnaea borealis*	Twinflower
Pleurozium schreberi	Red stem feather moss	*Picea mariana*	Black spruce
Vaccinium uliginosum	Bog whortleberry	*Stereocaulon tomentosum*	Woolly coral
Vaccinium vitis-idaea	Bog cranberry		
Black Spruce/Ericaceous Shrub: Clayey-Silty Fine Sandy Soil (Brunisols/Regosols)			
Betula nana (syn: *Betula glandulosa*)	Swamp birch	*Andromeda polifolia*	Bog-rosemary
Cladina mitis	Green reindeer lichen	*Betula pumila*	Swamp birch
Cladina rangiferina	Grey reindeer lichen	*Calamagrostis canadensis*	Blue-joint reed-grass
Cladina stellaris	Northern reindeer lichen	*Carex* spp.	Sedges
Empetrum nigrum	Black crowberry	*Cetraria islandica*	Iceland moss
Flavocetraria nivalis	Flattened snow lichen	*Equisetum sylvaticum*	Woodland or wood horsetail
Ledum palustre spp. *decumbens*	Narrow-leaved Labrador tea	*Geocaulon lividum*	Northern comandra
Ledum groenlandicum	Common Labrador tea	*Hylocomium splendens*	Stair step moss
Loiseleuria procumbens	Alpine azalea	*Kalmia polifolia*	Pale laurel
Picea mariana	Black spruce	*Larix laricina*	Tamarack
Pleurozium schreberi	Red stem feather moss	*Lycopodium complanatum*	Trailing club-moss or ground-cedar
Sphagnum spp.	Peat mosses	*Vaccinium oxycoccus*	Small cranberry
Stereocaulon tomentosum	Woolly coral	*Pedicularis* spp.	Lousewort

Table A7 **Vegetative Communities in the Tazin Lake Upland Ecoregion** (continued)

Dominant Vegetation		Ancillary Vegetation	
Scientific Name	Common Name	Scientific Name	Common Name
Black Spruce/Ericaceous Shrub: Clayey-Silty Fine Sandy Soil (Brunisols/Regosols)			
Vaccinium uliginosum	Bog whortleberry	*Peltigera* spp.	Leaf lichens (e.g., freckle pelt)
Vaccinium vitis-idaea	Bog cranberry	*Petasites frigidus* var. *palmatus*	Palmate-leaved coltsfoot
		Rubus chamaemorus	Cloudberry
		Salix spp.	Willows
White Birch/Ericaceous Shrub: Very Shallow Soil (Gleysol)			
Alnus viridis (syn: *Alnus crispa*)	Green alder	*Cladina* sp.	Reindeer lichens
Betula papyrifera	White birch	*Peltigera* sp.	Leaf lichens (e.g., freckle pelt)
Hylocomium splendens	Stair step moss	*Picea mariana*	Black spruce
Ledum groenlandicum	Common Labrador tea	*Pleurozium schreberi*	Red stem feather moss
Vaccinium vitis-idaea	Bog cranberry	*Pyrola asarifolia*	Pink wintergreen
		Ribes triste	Swamp red current
		Rubus idaeus	Red raspberry
Trembling Aspen: Sandy Soil (Brunisol)			
Cornus canadensis	Bunchberry	*Amelanchier alnifolia*	Saskatoon
Populus tremuloides	Trembling aspen	*Aralia nudicaulis*	Wild sarsaparilla
Rosa acicularis	Prickly rose	*Betula papyrifera*	White birch
		Calamagrostis canadensis	Blue-joint reed-grass
		Cornus sericea	Red-osier dogwood
		Chamerion angustifolium ssp. *angustifolium*	Narrow leaf fireweed
		Geocaulon lividum	Northern comandra
		Juniperus horizontalis	Creeping juniper
		Lonicera dioica	Wild honeysuckle
		Peltigera sp.	Leaf lichens (e.g., freckle pelt)
		Picea glauca	White spruce
		Pleurozium schreberi	Red stem feather moss
		Populus balsamifera	Balsam poplar
		Pyrola asarifolia	Pink wintergreen
		Orthilia secunda (syn: *Pyrola secunda*)	One-sided wintergreen
		Ribes triste	Swamp red currant
		Vaccinium vitis-idaea	Bog cranberry
		Viburnum edule	Low bush-cranberry
Black Spruce Bog/Fen Complex: Organic/Cryosolic Soils			
Cladina mitis	Green reindeer lichen	*Alnus incana* ssp. *rugosa*	Speckled alder
Cladina rangiferina	Grey reindeer lichen	*Andromeda polifolia*	Bog-rosemary
Flavocetraria nivalis	Flattened snow lichen	*Arctostaphylos rubra*	Red alpine bearberry
Hylocomium splendens	Stair step moss	*Betula nana* (syn: *Betula glandulosa*)	Swamp birch
Kalmia polifolia	Pale laurel	*Calamagrostis canadensis*	Blue-joint reed-grass
Ledum palustre spp. *decumbens*	Narrow-leaved Labrador tea	*Carex* sp.	Sedges
Ledum groenlandicum	Common Labrador tea	*Chamaedaphne calyculata*	Leatherleaf
Picea mariana	Black spruce	*Cladina stellaris*	Northern reindeer lichen
Rubus chamaemorus	Cloudberry	*Cornus canadensis*	Bunchberry
Sphagnum spp.	Peat mosses	*Empetrum nigrum*	Black crowberry
Vaccinium vitis-idaea	Bog cranberry	*Equisetum scirpoides*	Dwarf scouring-rush
		Eriophorum sp.	Cotton-grasses
		Icmadophila ericetorum	Spraypaint (crust lichens)
		Larix laricina	Tamarack
		Vaccinium oxycoccus	Small cranberry
		Peltigera sp.	Leaf lichens (e.g., freckle pelt)
		Pleurozium schreberi	Red stem feather moss
		Pyrola chlorantha	Greenish-flowered wintergreen
		Ribes sp.	Currants
		Rubus chamaemorus	Cloudberry
		Salix sp.	Willows
		Maianthemum trifolium	Three-leaf Solomon's-seal
		Vaccinium caespitosum	Dwarf billberry
		Vaccinium uliginosum	Bog whortleberry

Source: SERM

M121

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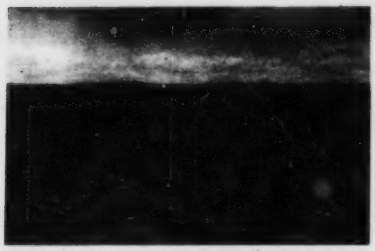
Forest Mensuration

Tree growth rates in the Tazin Lake Upland are quite variable even within similar site types. Table A8 provides average height, DBH and age for the species sampled on each of the site types.



Looking northeast over an extensive jack pine forest on the south shore of Tazin Lake. Note the open sand slopes along the south shore where deep sand deposits are eroded by the wave action of this very large lake.
Robert A. Wright

Table A8 Height, Diameter and Age of Trees on Site Types in the Tazin Lake Upland Ecoregion

Species	Height (m)	DBH (cm)	Age (years)
Jack Pine/Lichen: Dry Sandy Soil (Brunisols)			
Jack pine	10.8	11.6	80
Jack Pine-White Birch/Ericaceous Shrub: Loamy fine Sand Soil (Brunisols/Regosols)			
Jack pine	9.5	10.8	53
White birch	9.1	11.2	38
White Spruce- Jack Pine-White Birch/Feathermoss: Medium Sand Soil (Brunisols)			
White spruce	16.6	13.0	107
Jack pine	15.6	16.2	129
Black spruce	10.2	9.3	82
White birch	12.2	14.9	?
Black Spruce/Feathermoss: Silty Medium Sands (Brunisols/Regosols)			
Black spruce	8.6	8.6	101
Black spruce	10.1	9.7	82
White birch	6.0	7.5	?
Black Spruce/Ericaceous Shrub: Clayey - Silty fine Sandy Soil (Brunisols/Regosols)			
Black spruce	6.9	9	80
White Birch/Ericaceous Shrub: Very Shallow Soil (Gleysol)			
White birch	12.2	10.2	64
Black spruce	7.2	7.7	64
Trembling Aspen: Sandy Soil (Brunisol)			
Trembling aspen	17.2	14.9	80
Balsam poplar	13.5	9.8	40
Black Spruce Bog/Fen Complex: Organic/Cryosolic Soils			
Black spruce	6.9	9	80

Source: SERM

Appendix 3

Provincial and COSEWIC Rank Definitions

The following are standard codes and modifiers that are used in provincial and global status designations. These modifiers are used in Appendices 4 and 5. It is necessary to read the individual letters, except for HYB (hybrid of species), SYN (synonym) and RF (falsely reported in province).

Examples:

SZN=Saskatchewan, no conservation concern, migratory species

SEC=Saskatchewan, exotic species, species exists only in captivity or cultivation

SRF=Saskatchewan, falsely reported but error persists in the literature

S5B=Saskatchewan, very common, migratory species

G5=global, very common

Codes and Modifiers

A – accidental or casual in the province, including species (such as birds or butterflies) recorded infrequently that are far outside their range

B – for a migratory species, rank applies to the breeding population in the province

C – species presently exists in the province only in captivity or cultivation

E – exotic species established in the province, may be native to nearby regions

H – historical occurrence but without recent verification (e.g., within 20 years)

HYB – hybrid of species

N – for a migratory species, rank applies to the non-breeding population in the province

P – potentially exists in the province but no occurrences reported

Q – taxonomic difficulties, more information needed

R – reported in province but lacks documentation which would provide a basis for accepting or rejecting the report (e.g., misidentified specimen)

RF – falsely reported for the province but the error persists in the literature

SYN – synonym: element reported as occurring in the province, but the province does not recognize the taxon

T – indicates uncertainty in the taxonomy, e.g., is the variety or subspecies designation valid?

U – status uncertain in Saskatchewan, because of limited information

X – believed to be extinct or extirpated

Z – no practical conservation concern since there are no mappable and predictable occurrences (migrants)

? – not yet ranked in Saskatchewan

Note:

G – refers to global, a range-wide rank

S – refers to sub-national or, in our case, within Saskatchewan

N – refers to national rank or, in our case, in Canada

The following table explains the meaning of the different ranks, which are part of the provincial status system and are used in Appendices 4 and 5.

Provincial Rank Definitions

Rank	Status	Definition	Comments
1	Extremely Rare	5 or fewer occurrences in Saskatchewan, or very few remaining individuals	Critically imperiled; may be especially susceptible to extirpation because of some factor of its biology
2	Rare	6 to 20 occurrences in Saskatchewan or few remaining individuals	Imperiled; may be susceptible to extirpation because of some factor of its biology
3	Rare - Uncommon	21 to 100 occurrences in Saskatchewan; may be rare and local throughout province or may occur in a restricted provincial range (may be abundant in places)	Vulnerable; may be susceptible to extirpation by large scale disturbances
4	Common	More than 100 occurrences; generally widespread and abundant, but may be rare in parts of its range	Apparently secure but may be of long-term concern
5	Very Common	More than 100 occurrences; widespread and abundant, but may be rare in parts of its range	Demonstrably secure

Forest Mensuration

Tree growth rates in the Tazin Lake Upland are quite variable even within similar site types. Table A8 provides average height, DBH and age for the species sampled on each of the site types.

Looking northeast over an extensive jack pine forest on the south shore of Tazin Lake. Note the open sand slopes along the south shore where deep sand deposits are eroded by the wave action of this very large lake.
Robert A. Wright

Table A8 Height, Diameter and Age of Trees on Site Types in the Tazin Lake Upland Ecoregion

Species	Height (m)	DBH (cm)	Age (years)
Jack Pine/Lichen: Dry Sandy Soil (Brunisols)			
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White Spruce- Jack Pine-White Birch/Feathermoss: Medium Sand Soil (Brunisols)			
White spruce	16.6	13.0	107
Jack pine	15.6	16.2	129
Black spruce	10.2	9.3	62
White birch	12.2	14.9	?
Black Spruce/Feathermoss: Silty Medium Sands (Brunisols/Regosols)			
Black spruce	8.6	8.6	101
Black spruce	10.1	9.7	82
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Black spruce	6.9	9	80
White Birch/Ericaceous Shrub: Very Shallow Soil (Gleysol)			
White birch	12.2	10.2	64
Black spruce	7.2	7.7	64
Trembling Aspen: Sandy Soil (Brunisol)			
Trembling aspen	17.2	14.9	80
Balsam poplar	13.5	9.8	40
Black Spruce Bog/Fen Complex: Organic/Cryosolic Soils			
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Appendix 3

Provincial and COSEWIC Rank Definitions

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HYB – hybrid of species

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X – believed to be extinct or extirpated

Z – no practical conservation concern since there are no mappable and predictable occurrences (migrants)

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Note:

G – refers to global, a range-wide rank

S – refers to sub-national or, in our case, within Saskatchewan

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The following table explains the meaning of the different ranks, which are part of the provincial status system and are used in Appendices 4 and 5.

Provincial Rank Definitions

Rank	Status	Definition	Comments
1	Extremely Rare	5 or fewer occurrences in Saskatchewan, or very few remaining individuals	Critically imperiled; may be especially susceptible to extirpation because of some factor of its biology
2	Rare	6 to 20 occurrences in Saskatchewan or few remaining individuals	Imperiled; may be susceptible to extirpation because of some factor of its biology
3	Rare - Uncommon	21 to 100 occurrences in Saskatchewan; may be rare and local throughout province or may occur in a restricted provincial range (may be abundant in places)	Vulnerable; may be susceptible to extirpation by large scale disturbances
4	Common	More than 100 occurrences; generally widespread and abundant, but may be rare in parts of its range	Apparently secure but may be of long-term concern
5	Very Common	More than 100 occurrences; widespread and abundant, but may be rare in parts of its range	Demonstrably secure

The following table explains the COSEWIC status system. No numbers are assigned and this information does not appear in Appendices 4 and 5.

COSEWIC Rank Definitions

COSEWIC Status	Definition
Special Concern	A species of special concern because of characteristics that make it particulary sensitive to human activities of natural events
Threatened	A species likely to become endangered if limiting factors are not reversed
Endangered	A species facing imminent extirpation or extinction
Extirpated	A species no longer existing in the wild in Canada, but occurring elsewhere
Extinct	A species that no longer exists
NIAC (Not in any category)	A species whose status has been reviewed by COSEWIC and is considered secure
Insufficient Info.	A species whose status remains uncertain due to insufficient information

The following table explains the COSEWIC status system. No numbers are assigned and this information does not appear in Appendices 4 and 5.

COSEWIC Rank Definitions

COSEWIC Status	Definition
Special Concern	A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events
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Insufficient Info.	A species whose status remains uncertain due to insufficient information

Status definitions, as determined by COSEWIC

Appendix 4

Flora (Vascular Plants) of the Taiga Shield Ecozone

(*Note:* See Appendix 3 for status codes and modifiers)

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Achillea millefolium		Common yarrow/milfoil	G5	S5
Achillea sibirica	*Achillea multiflora*	Siberian yarrow	G5?	S5
Actaea rubra		Red baneberry	G5	S5
Agrostis mertu...	*Agrostis borealis, Agrostis bakeri, Agrostis borealis, Agrostis borealis* var. *americana, Agrostis borealis* var. *paludosa, Agrostis idahoensis* var. *bakeri, Agrostis mertensii* ssp. *borealis, Agrostis rupestris*	Northern bent-grass	G5	S1, S2
Agrostis scabra	*Agrostis geminata, Agrostis hyemalis* var. *geminata, Agrostis hyemalis* var. *tenuis, Agrostis scabra* ssp. *septentrionalis, Agrostis scraba* var. *geminata, Agrostis scabra* var. *septentrionalis*	Rough hair grass	G5	S?
Allium schoenoprasum var. *sibiricum*	*Allium sibiricum*	Siberian or wild chives	G5, T5	S2
Alnus incana		Speckled alder	G5	S5
Alnus incana ssp. *tenuifolia*	*Alnus rugosa* var. *occidentalis*	Mountain alder	G5, T5	S5
Alnus viridis	*Alnus crispa*	Green alder	G5	S5
Alnus viridis ssp. *crispa*	*Alnus crispa* ssp. *crispa*	Green alder	G5, T5	S5
Alnus viridis ssp. *sinuata*	*Alnus crispa* ssp. *sinuata*	Green alder	G5, T5	SRF
Alopecurus aequalis	*Alopecurus aequalis* var. *natans, Alopecurus aristulatus, Alopecurus geniculatus* var. *aristulus*	Short-awned foxtail	G5	S?
Alopecurus aequalis var. *aequalis*	*Alopecurus aequalis* var. *natans, Alopecurus aristulatus, Alopecurus geniculatus* var. *aristulus*	Short-awn meadow-foxtail	G5, T?	S5?
Amelanchier alnifolia		Saskatoon	G5	S5
Andromeda polifolia		Bog-rosemary	G5	S5
Andromeda polifolia var. *polifolia*	*Andromeda polifolia* var. *concolor*	Bog-rosemary	G5, T5	S5

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Androsace septentrionalis		Pygmy-flower	G5	S?
Androsace septentrionalis ssp. *puberulenta*	*Androsace puberulenta*, *Androsace septentrionalis* var. *puberulenta*	Pygmy-flower rock-jasmine	G5, T?	S5?
Androsace septentrionalis ssp. *septentrionalis*		Pygmy-flower rock-jasmine	G5, T?	S?
Anemone multifida		Cut-leaved anemone	G5	S5
Anemone parviflora		Small-flowered anemone	G5	S1
Anemone richardsonii	*Jurtzevia richardsonii*	Yellow or Richardson's anemone	G5	S1
Antennaria microphylla	*Antennaria parvifolia*, *Antennaria bracteosa*, *Antennaria nitida*, *Antennaria parvifolia* var. *bracteosa*, *Antennaria rosea* var. *nitida*, *Antennaria solitifolia*	Small-leaved pussytoes	G4, G5	S5
Antennaria pulcherrima	*Antennaria carpatica* var. *pulcherrima*, *Antennaria pulcherrima* var. *angustisquama*, *Antennaria pulcherrima* var. *sordida*	Showy everlasting	G4, G5	S4
Antennaria rosea		Rosy everlasting	G4, G5	S4
Antennaria umbrinella	*Antennaria alnoides*, *Antennaria flavescens*, *Antennaria reflexa*	Brown-bracted pussytoes	G5	S2, S3
Apocynum androsaemifolium	*Apocynum ambigens*, *Apocynum androsaemifolium* ssp. *pumilum*, *Apocynum androsaemifolium* var. *glabrum*, *Apocynum androsaemifolium* var. *grisenii*, *Apocynum androsaemifolium* var. *incanum*, *Apocynum androsaemifolium* var. *intermedium*	Spreading dogbane	G5	S5
Apocynum cannabinum	*Apocynum cannabinum* var. *angustifolium*, *Apocynum cannabinum* var. *glaberrimum*, *Apocynum cannabinum* var. *grenieranum*, *Apocynum cannabinum* var. *hypericifolium*, *Apocynum cannabinum* var. *nemorale*, *Apocynum cannabinum* var. *pubescens*	Indian hemp	G5	S5?
Arabis arenicola		Arctic rockcress	G4	S2
Arabis hirsuta		Hirsute rockcress	G5	S5
Arabis holboellii var. *retrofracta*	*Arabis arcuata* var. *secunda*, *Arabis caduca*, *Arabis consanguinea*, *Arabis exilis*, *Arabis holboellii* var. *consanguinea*, *Arabis holboellii* var. *secunda*, *Arabis holboellii* var. *texana*, *Arabis kochii*, *Arabis lignifera*, *Arabis mexicana*, *Arabis pallidiflora*	Reflexed rockcress	G5, T5	S5

Flora (Vascular Plants) of the Taiga Shield Ecozone

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Arabis holboellii var. *collinsii*	*Arabis retrofracta* var. *collinsii*, *Arabis bourgovii*, *Arabis collinsii*, *Arabis dacotica*, *Arabis divaricarpa* var. *dacotica*, *Boechera collinsii*		G5, T5?	S?
Arabis lyrata	*Arabis lyrata* var. *glabra*	Lyre-leaf rockcress	G5	S4?
Aralia nudicaulis		Wild sarsaparilla	G5	S5
Arctostaphylos alpina		Alpine bearberry	G5	SR
Arctostaphylos rubra	*Arctostaphylos alpina* ssp. *rubra*, *Arctostaphylos alpina* var. *rubra*, *Arctous erythrocarpa*, *Arctous rubra*	Red alpine bearberry	G5	S3
Arctostaphylos uva-ursi	*Arctostaphylos adenotricha*, *Arctostaphylos uva-ursi* ssp. *adenotricha*, *Arctostaphylos uva-ursi* ssp. *coactilis*, *Arctostaphylos uva-ursi* ssp. *longipilosa*, *Arctostaphylos uva-ursi* ssp. *monoensis*, *Arctostaphylos uva-ursi* ssp. *stipitata*, *Arctostaphylos uva-urs*	Bearberry	G5	S5
Arenaria macrophylla	*Moehringia macrophylla*	Large-leaved sandwort	G4	S2
Arnica alpina		Alpine arnica	G5	SRF
Arnica angustifolia	*Arnica alpina* ssp. *attenuata*	Arctic arnica	G5	S1?
Arnica lonchophylla		Spear-leaved arnica	G4	S2, S3?
Arnica lonchophylla ssp. *lonchophylla*	*Arnica alpina* ssp. *lonchophylla*, *Arnica alpina* var. *lonchophylla*, *Arnica angustifolia* ssp. *lonchophylla*, *Arnica chionopappa*, *Arnica gaspensis*, *Arnica lonchophylla* ssp. *chionopappa*	Spear-leaved arnica	G4, T4	S2, S3
Artemisia biennis		Biennial wormwood/ sagewort	G5	S5
Artemisia campestris		Sagewort wormwood	G5	S5?
Artemisia frigida		Pasture sage	G5?	S5
Aster borealis	*Aster junciformis*, *Symphyotrichum boreale*	Northern aster	G5	S5
Aster falcatus	*Symphyotrichum falcatum* var. *falcatum*	Creeping white prairie aster	G4, G5	S5
Aster lanceolatus	*Aster hesperius*, *Aster lanceolatus* ssp. *hesperius*, *Symphyotrichum lanceolatum* ssp. *lanceolatum*	Western willow aster	G5	S5
Aster subspicatus		Leafy-bracted aster	G5	S?
Astragalus alpinus		Alpine milk-vetch	G5	S5?
Astragalus alpinus var. *alpinus*	*Astragulus alpinus* ssp. *alaskanus*, *Astragulus alpinus* ssp. *arcticus*, *Astragulus astragalinus*, *Atelophragma alpinum*	Alpine milk-vetch	G5, T5	S5?

Flora (Vascular Plants) of the Taiga Shield Ecozone

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Astragalus americanus	*Astragalus frigidus, Astragalus frigidus* var. *americanus, Astragalus frigidus* var. *gaspensis, Phaca americana*	American milk-vetch	G5	S5
Astragalus eucosmus	*Astragalus eucosmus* ssp. *sealei, Astagalus eucosmus* var. *facinorum, Astragalus parviflorus, Astragalus sealei, Atelophragma elegans*	Pretty milk-vetch	G5	S4?
Barbarea orthoceras		American winter cress	G5	S5?
Betula nana	*Betula glandulosa*	Swamp birch	G5	S5
Betula neoalaskana	*Betula paperifera* var. *neoalaskana*	Alaska paper birch	G4, G5	S5
Betula occidentalis	*Betula fontinalis*	River birch	G4, G5	S5?
Betula papyrifera		White birch	G5	S5
Betula papyrifera var. *papyrifera*		White birch	G5, T5	S5
Betula papyrifera var. *commutata*	*Betula papyrifera* var. *papyrifera papyrifera*	Western paper birch	G5, T5	S5?
Betula pumila		Swamp birch	G5	S5
Betula pumila var. *glandulifera*	*Betula glandulifera, Betula glandulosa* var. *glandulifera, Betula nana* var. *glandulifera*	Swamp birch	G5, T5	S5
Betula x Eastwoodiae	*Betula occidentalis x Betula nana glandulosa*	Hybrid birch	HYB	S4?
Betula x Sargentii	*Betula nana glandulosa x Betula pumila glanulifera*	Hybrid birch	HYB	S4?
Betula x Utahensis	*Betula occidentalis x Betula papyrifera*	Hybrid birch	HYB	S4?
Betula x Winteri	*Betula papyrifera x Betula neoalaskana*	Hybrid birch	HYB	S4?
Botrychium virginianum	*Botrychium virginianum* ssp. *europaeum, Botrychium virginianum* var. *europaeum*	Rattlesnake fern	G5	S5
Brassica napus		Turnip	G?	SE
Brassica rapa		Bird's rape	G?	SE
Calamagrostis canadensis var. *canadensis*	*Calamagrostis anomala, Calamagrostis atropurpurea, Calamagrostis canadensis* var. *pallida, Calamagrostis canadensis* var. *robusta, Calamagrostis canadensis* var. *typica, Calamagrostis expansa* var. *robusta, Calamagrostis inexpansa* var. *cuprea*	Blue-joint reed-grass	G5, T?	S?
Calamagrostis canadensis var. *macouniana*	*Calamagrostis macouniana*	Blue-joint reed-grass	G5, T5?	S?

Flora (Vascular Plants) of the Taiga Shield Ecozone

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Calamagrostis lapponica	*Calamagrostis lapponica* var. *alpina*, *Calamagrostis lapponica* var. *groenlandica*, *Calamagrostis lapponica* var. *nearctica*	Lapland reed-grass	G5	S?
Calamagrostis lapponica var. *nearctica*		Lapland reed-grass	G5, T?	S2, S3
Calamagrostis purpurascens		Purple reed-grass	G5?	S2
Calla palustris		Water calla	G5	S5
Calypso bulbosa		Fairy slipper	G5	S3
Calypso bulbosa var. *americana*	*Cytherea bulbosa*	Fairy-slipper orchid	G5T?	S3
Camelina sativa		False flax	G?	SE
Campanula rotundifolia		Harebell	G5	S5
Caragana arborescens		Common caragana	G?	SE5
Cardamine pensylvanica		Bitter cress	G5	S5?
Cardamine pratensis		Cuckooflowor; meadow or cuckoo bittercress	G5	S2
Cardamine pratensis var. *angustifolia*		Meadow bitter cress	G5, T5	SU
Carex abdita	*Carex umbellata* var. *brevirostris*	Hidden or umbellate sedge	G3, G5, Q	S2
Carex aenea	*Carex siccata*	Silvery-flowered sedge	G5	S5?
Carex aquatilis		Water sedge	G5	S5
Carex atherodes		Awned sedge	G5	S5
Carex athrostachya		Long-bracted sedge	G5	S5?
Carex aurea		Golden sedge	G5	S5?
Carex bicolor		Two-color sedge	G5	S1
Carex bigelowii	*Carex bigelowii* ssp. *hyperborea*, *Carex consimilis*	Bigelow's sedge	G5	S1
Carex buxbaumii		Brown sedge	G5	S2
Carex canescens		Short sedge	G5	S5?
Carex capillaris	*Carex boecheriana*, *Carex capillaris* ssp. *chlorostachys*, *Carex capillaris* ssp. *robustior*, *Carex capillaris* var. *elongata*, *Carex capillaris fuscidula*, *Carex capillaris* var. *major*	Hair-like sedge	G5	S5?

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Carex capitata		Capitate sedge	G5	S5?
Carex chordorrhiza		Prostrate sedge	G5	S5?
Carex concinna		Beautiful sedge	G4, G5	S5?
Carex deflexa		Bent sedge	G5	S5?
Carex diandra		Two-stamened sedge	G5	S5?
Carex eburnea		Sedge	G5	SRF
Carex eburnea		Bristle-leaved sedge	G5	S2
Carex foenea	*Carex siccata*, *Carex foenea* var. *enervis*, *Carex foenea* var. *tuberculata*	Dry-spike sedge	G5	S?
Carex garberi	*Carex garberi* ssp. *bifaria*, *Carex garberi* var. *bifaria*	Garber's sedge	G4	S2
Carex glacialis		Glacier sedge	G5	S1
Carex gynocrates	*Carex dioica* ssp. *gynocrates*, *Carex dioica* var. *gynocrates*, *Carex parallela*	Northern bog sedge	G5	S?
Carex hookeriana		Hooker's sedge	G4?	S?
Carex lasiocarpa		Hairy-fruited sedge	G5	S5?
Carex leptalea		Bristle-stalked sedge	G5	S5
Carex limosa		Mud sedge	G5	S?
Carex norvegica		Norway sedge	G5	S?
Carex obtusata		Blunt sedge	G5	S5?
Carex oligosperma		Few-fruited sedge	G4	S?
Carex praegracilis	*Carex camporum*	Graceful sedge	G5	S?
Carex raymondii	*Carex atratiformis* ssp. *raymondii*	Black sedge	G5	S?
Carex rostrata	*Carex rostrata* var. *ambigens*	Beaked sedge	G5	S?
Carex saxatilis	*Carex miliaris*, *Carex physocarpa*, *Carex rhomalea*, *Carex rotundata* var. *compacta*, *Carex saxatilis* ssp. *laxa*, *Carex saxatilis* var. *miliaris*, *Carex saxatilis* var. *rhomalea*	Rocky ground or bubble sedge	G5	S2
Carex supina var. *spaniocarpa*	*Carex supina* ssp. *spaniocarpa*	Weak arctic sedge	G5, T?	S1
Carex vaginata	*Carex saltuensis*	Sheathed sedge	G5	S5
Castilleja raupii		Purple or northern paintbrush	G5?	S2

Flora (Vascular Plants) of the Taiga Shield Ecozone

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Cerastium alpinum		Alpine chickweed	G5?	S1
Cerastium alpinum var. *strigosum*	*Cerastium alpinum* ssp. *lanatum* var. *strigosum*	Alpine mouse-ear chickweed	G5?, T?	S1
Cerastium beeringianum		Beering's chickweed	G5	S1
Cerastium beeringianum ssp. *terrae-novae*		Newfoundland chickweed	G5, T4?	S1
Cerastium nutans		Long-stalked chickweed	G5	S5?
Chamaedaphne calyculata	*Cassandra calyculata* var. *angustifolia*, *Chamaedaphne calyculata* var. *angustifolia*, *Chamaedaphne calyculata* var. *latifolia*, *Chamaedaphne calyculata* var. *nana*	Leatherleaf	G5	S5
Chamerion angustifolium ssp. *angustifolium*	*Chamaenerion angustifolium*, *Chamerion spicatum*, *Epilobium angustifolium*, *Epilobium angustifolium* var. *intermedium*	Narrow-leaf fireweed	G5, T?	S?
Chamerion angustifolium ssp. *circumvagum*	*Chamaenerion angustifolium* ssp. *circumvagum*, *Chamerion danielsii*, *Chamerion platyphyllum*, *Epilobium angustifolium* ssp. *circumvagum*, *Epilobium angustifolium* ssp. *macrophyllum*, *Epilobium angustifolium* var. *abbreviatum*	Narrow-leaf fireweed	G?	S?
Chenopodium capitatum		Strawberry blight	G5	S5
Chimaphila umbellata ssp. *occidentalis*	*Chimpaphila occidentalis*, *Chimaphila umbellata* var. *occidentalis*	Western prince's-pine	G5, T5	S2, S3
Chimaphila umbellata		Pipsissewa	G5	S5?
Chrysosplenium tetrandrum	*Chrysosplenium alternifolium* ssp. *tetrandrum*, *Chrysosplenium alternifolium* var. *tetrandrum*	Golden saxifrage	G5	S5
Cicer arietinum		Chickpea	G?	SEC
Cirsium arvense	*Breea arvensis*, *Carduus arvensis*, *Cirsium arvense* var. *argenteum*, *Cirsium arvense* var. *horridum*, *Cirsium arvense* var. *integrifolium*, *Cirsium arvense* var. *mite*, *Cirsium arvense* var. *vestitum*, *Cirsium incanum*, *Cirsium setosum*, *Serratula arvensis*	Canada thistle	G?	SE5
Collomia linearis		Narrow-leaved collomia	G5	S5
Comandra umbellata		Bastard toadflax	G5	S5
Conringia orientalis		Hare's-ear mustard	G?	SE

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Coptis trifolia	*Coptis groenlandica, Coptis* ssp. *groenlandica, Coptis trifolia* var. *groenlandica*	Goldthread	G5	S5
Cornus sericea	*Cornus stolonifera*	Red-osier dogwood	G5	S5
Corydalis aurea	*Capnoides aureum, Corydalis washingtoniana*	Golden corydalis	G5	S5
Corydalis sempervirens	*Capnoides sempervirens*	Pink corydalis	G4, G5	S5?
Cypripedium passerinum	*Cypripedium passerinum* var. *minganense*	Sparrow's-egg lady's-slipper	G4, G5	S2
Cystopteris fragilis	*Cystopteris dickieana, Cystopteris fragilis* ssp. *dickieana, Cystopteris fragilis* var. *angustata, Cystopteris fragilis* var. *woodsioides, Filix fragilis*	Fragile bladder fern	G5	S5
Dichanthelium acuminatum	*Panicum subvillosum, Panicum lanuginosum* var. *implicatum*	Hairy or woolly panic-grass	G5	S2
Dodecatheon pulchellum		Saline shootingstar	G5	S?
Draba aurea		Golden whitlow-grass	G5	S1
Draba cana	*Draba lanceolata*	Hoary whitlow-grass	G5	S1
Draba cinerea		Ashy whitlow-grass	G5	S1
Draba nemorosa		Yellow whitlow-grass	G5	S5?
Dryas drummondii		Yellow mountain-avens	G5	S1
Dryopteris filix-mas		Male fern	G5	S1
Dryopteris fragrans		Fragrant shield fern	G5	S5
Dryopteris fragrans var. *remotiuscula*		Fragrant fern	G5, T?	S4?
Eleocharis acicularis	*Eleocharis acicularis* var. *gracilescens, Eleocharis acicularis* var. *occidentalis, Eleocharis acicularis* var. *submersa, Eleocharis acicularis* var. *typica*	Needle spike-rush	G5	S5
Eleocharis nitida		Neat spike-rush	G3, G4	S2
Elymus mollis ssp. *mollis*	*Elymus mollis*	Sea lyme-grass; American dune grass; dune wild-rye	G5	S2
Empetrum nigrum		Black crowberry	G5	S5
Empetrum nigrum ssp. *hermaphroditum*	*Empetrum eamesii* ssp. *hermaphroditum, Empetrum hermaphroditum*	Black crowberry	G5, T5	S5
Epilobium ciliatum		Northern willowherb	G5	S?

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Equisetum arvense	*Equisetum arvense* var. *alpestre*, *Equisetum arvense* var. *boreale*, *Equisetum arvense* var. *campestre*, *Equisetum arvense* var. *riparium*, *Equisetum calderi*	Common horsetail	G5	S?
Equisetum fluviatile	*Equisteum fluviatile* var. *limosum*, *Equitsetum limosum*	Swamp horsetail	G5	S?
Equisetum scirpoides		Dwarf scouring-rush	G5	S?
Equisetum sylvaticum	*Equisetum sylvaticum* var. *multiramosum*, *Equisetum sylvaticum* var. *pauciramosum*	Woodland or wood horsetail	G5	S?
Equisetum variegatum		Variegated horsetail	G5	S?
Equisetum variegatum var. *variegatum*	*Equisetum variegatum* var. *anceps*, *Hippochaete variegata*	Variegated scouring-rush	G5, T?	S?
Erigeron hyssopifolius		Hyssop-leaved fleabane	G5	S2
Eriophorum angustifolium		Tall cotton-grass	G5	S5
Eriophorum brachyantherum		Close-sheathed cotton-grass	G5	S5?
Eriophorum chamissonis	*Eriophorum russeolum* ssp. *rufescens*	Russet cotton-grass	G5	S5
Erucastrum gallicum	*Brassica erucastrum*	Dog mustard	G5	SE
Erysimum cheiranthoides		Wormseed mustard	G5	SE5
Euphrasia arctica var. *disjuncta*		Eyebright	G5	S?
Euphrasia subarctica	*Euphrasia arctica* var. *disjuncta*, *Euphrasia arctica* var. *dolosa*, *Euphrasia disjuncta* var. *dolosa*, *Euphrasia pennellii*	Arctic eyebright	G5, Q	S1, S2
Euthamia graminifolia	*Solidago graminifolia*	Flat-topped goldenrod	G5	S5
Euthamia graminifolia var. *graminifolia*	*Euthamia floribunda*, *Euthamia graminifolia* var. *major*, *Euthamia graminifolia* var. *nuttallii*, *Euthamia nuttallii*, *Solidago graminifolia*, *Solidago graminifolia* var. *major*, *Solidago graminifolia* var. *nuttallii*, *Solidago graminifolia* var. *polycephala*	Flat-topped goldenrod	G5, T5	S5
Fagopyrum esculentum	*Fagopyrum sagittatum*	Common buckwheat	G?	SEC
Fagopyrum tataricum	*Polygonum tataricum*	Tartary buckwheat	G?	SEC
Festuca brachyphylla ssp. *brachyphylla*	*Festuca ovina* var. *brachyphylla*, *Festuca brevifolia*, *Festuca brevifolia* subvar. *genuina*, *Festuca ovina* ssp. *brevifolia*, *Festuca ovina* var. *alpina*, *Festuca ovina* var. *borealis*, *Festuca ovina* var. *brevifolia*, *Festuca ovina*	Short-leaf fescue	G5, T?	S?

Flora (Vascular Plants) of the Taiga Shield Ecozone

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Festuca brachyphylla		Alpine fescue	G5	S1, S2
Festuca ovina	*Festuca ovina* var. *brachyphylla*, *Festuca brevifolia*, *Festuca brevifolia* subvar. *genuina*, *Festuca ovina* ssp. *brevifolia*, *Festuca ovina* var. *alpina*, *Festuca ovina* var. *borealis*, *Festuca ovina* var. *brevifolia*, *Festuca brachyphylla* ssp. *brachyphylla*	Sheep fescue	G?	SE?
Festuca rubra		Red fescue	G5	S?
Festuca saximontana		Rocky mountain fescue	G5	S?
Fragaria virginiana		Smooth wild strawberry	G5	S?
Galium labradoricum	*Galium tinctorium* var. *labradoricum*	Bog bedstraw	G5	S5?
Gentianella amarella		Northern gentian	G5	S5
Geocaulon lividum	*Comandra lividum*	Northern comandra	G5	S5
Glyceria borealis	*Panicularia borealis*	Northern manna grass	G5	S?
Glyceria pulchella		Graceful manna grass	G5	S?
Goodyera repens	*Goodyera ophioides*, *Goodyera repens* ssp. *ophioides*, *Goodyera repens* var. *ophioides*, *Peramium ophioides*	Lesser rattlesnake-plantain	G5	S5
Gymnocarpium dryopteris	*Dryopteris dryopteris*, *Dryopteris linnaeana*, *Phegopteris dryopteris*, *Thelypteris dryopteris*	Oak fern	G5	S5
Gymnocarpium jessoense		Northern oak fern	G5	S2, S3
Gymnocarpium jessoense ssp. *parvulum*		Limestone oak fern	G5, T4	S2, S3
Gymnocarpium robertianum	*Dryopteris robertiana*, *Gymnocarpium dryopteris* var. *pumilum*, *Phegopteris robertiana*	Limestone oak fern	G5	SRF
Hedysarum boreale		Northern hedysarum	G5	S5?
Hedysarum boreale ssp. *mackenziei*	*Hedysarum boreale* var. *mackensiei*, *Hedsarum mackensiei*	Boreal sweet-vetch	G5, T?	S5?
Heracleum maximum	*Heracleum lanatum*, *Heracleum sphondylium* ssp. *montanum*, *Heracleum sphondylium* var. *lanatum*	Cow parsnip	G5	S5
Hesperis matronalis		Dame's rocket	G4, G5	SE
Hippuris vulgaris		Common mare's-tail	G5	S5
Hordeum jubatum		Wild barley or fox-tail barley	G5	S?

Flora (Vascular Plants) of the Taiga Shield Ecozone

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Huperzia selago var. *densa*	*Lycopodium selago* var. *appressum*	Mountain or northern club-moss or fir-moss	G5, T?	S1
Isoetes macrospora		Large-spored quillwort	G5	S1
Juncus albescens	*Juncus triglumis* ssp. *albescens*	Pale three-flowered rush	G5	S1
Juncus balticus var. *montanus*	*Juncus arcticus* ssp. *ater*, *Juncus arcticus* var. *montanus*, *Juncus ater*	Baltic rush	G5, T?	S?
Juncus balticus var. *littoralis*	*Juncus arcticus* ssp. *littoralis*, *Juncus arcticus* var. *littoralis*	Baltic rush	G5, T5	S?
Juncus brevicaudatus		Short-tail rush	G5	S?
Juncus nevadensis var. *nevadensis*		Sierra rush/Nevada rush	G5, T?	S?
Juncus stygius ssp. *americanus*	*Juncus stygius* var. *americanus*	Moor or American bog rush	G5, T5	S1, S2
Juniperus communis		Ground juniper	G5	S?
Juniperus horizontalis		Creeping juniper	G5	S?
Kalmia polifolia	*Chamaedaphne glauca*, *Kalmia polifolia* var. *rosmarinifolia*	Pale laurel	G5	S5
Larix laricina	*Larix alaskensis*, *Larix laricina* var. *alaskensis*	Tamarack or American larch	G5	S5
Lathyrus ochroleucus		Cream-coloured vetchling	G4, G5	S5
Ledum groenlandicum	*Ledum palustre* ssp. *groenlandicum*, *Ledum palustre* var. *latifolium*, *Rhododendron groenlandicum*	Common Labrador tea	G5	S5
Ledum palustre		Labrador tea	G5	S2, S3
Ledum palustre ssp. *decumbens*	*Ledum decumbens*, *Ledum palustre* var. *decumbens*, *Rhododendron tomentosum* ssp. *subarcticum*	Narrow-leaved Labrador tea	G5, T?	S2, S3
Lemna minor	*Lemna cyclostasa*, *Lemna minima*	Lesser duckweed	G5	S5
Lemna trisulca		Ivy-leaved duckweed	G5	S5
Lepidium densiflorum var. *densiflorum*		Miner's pepperwort	G5, T?	S5, E?
Lepidium densiflorum		Common pepper-grass	G5	S5
Leymus arenarius	*Elymus arenarius*, *Elymus mollis*	Wild rye	G?	S?
Linaria vulgaris	*Linaria linaria*	Yellow toad-flax	G?	SE
Linnaea borealis		Twinflower	G5	S5

Flora (Vascular Plants) of the Taiga Shield Ecozone

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Linum lewisii	*Linum perenne var. lewisii*	Lewis wild flax	G4, G5	S5
Lobelia dortmanna		Water lobelia	G4	S2, S3
Loiseleuria procumbens	*Azalea procumbens, Chamaecistus procumbens, Kalmia procumbens*	Alpine azalea	G5	S1
Lonicera dioica		Wild honeysuckle	G5	S5
Luzula confusa		Northern or confusing wood-rush	G5	S1
Luzula multiflora		Many-flowered wood-rush	G5	S2
Luzula multiflora ssp. multiflora			G5, T5	S?
Luzula parviflora	*Juncoides parviflorum, Juncus melanocarpus, Juncus parviflorus, Luzula melanocarpa, Luzula parviflora ssp. melanocarpa, Luzula parviflora var. melanocarpa*	Small-flowered wood-rush	G5	S?
Lycopodium complanatum	*Diphasiastrum complanatum, Diphasium anceps, Diphasium complanatum, Diphasium complanatum ssp. muelleli, Diphasium wolfrothii, Lycopodium anceps, Lycopodium complanatum ssp. anceps, Lycopodium complanatum var. canadense*	Trailing club-moss or ground-cedar	G5	S?
Lycopodium annotinum var. pungens		Stiff ground-pine	G5, T?	S?
Lycopodium annotinum var. acrifolium		Stiff ground-pine	G5, T?	S?
Lycopodium annotinum	*Lycopodium annotinum ssp. alpestre, Lycopodium annotinum ssp. pungens, Lycopodium annotinum var. acrifolium, Lycopodium annotinum alpestre, Lycopodium annotinum var. pungens, Lycopodium dubium*	Stiff club-moss	G5	S?
Lycopodium clavatum	*Lycopodium clavatum var. laurentianum, Lycopodium clavatum var. subremotum, Lycopodium clavatum var. tristachum*	Running club-moss	G5	S?
Lycopodium selago var. selago	*Lycopodium selago var. selago*	Mountain or northern club-moss or fir-moss	G5, T?	S1
Lycopodium sitchense	*Diphasiastrum sitchense, Diphasium sitchense, Lycopodium sabinifolium ssp. sitchense, Lycopodium sabinifolium var. sitchense*	Alaskan club-moss	G5	S2
Lysimachia thyrsiflora	*Naumburgia thyrsiflora*	Tufted loosestrife	G5	S5?
Maianthemum canadense	*Maianthemum canadense var. interius, Maianthemum canadense var. pubescens, Unifolium canadense*	Two-leaved Solomon's-seal	G5	S5

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Maianthemum stellatum	*Smilacina stellata, Convallaria stellata, Smilacina sessilifolia, Smilacina stellata var. crassa, Smilacina stellata* var. *mollis, Smilacina stellata var. sessilifolia, Smilacina stellata var. sylvatica, Vagnera sessilifolia, Vagnera stellata*	False Solomon's-seal	G5	S5?
Malaxis paludosa	*Hammarbya paludosa*	Bog adder's-mouth orchid	G4	S1
Matricaria discoidea	*Matricaria matricarioides, Chamomilla suaveolens*	Pineapple-weed	G5	SE5
Medicago sativa		Alfalfa	G?	SE5
Melampyrum lineare		Cow-wheat	G5	SE
Melilotus officinalis	*Melilotus alba, Melilotus albus* var. *annua*	Yellow sweet-clover	G?	SE5
Mertensia paniculata var. *paniculata*		Tall bluebells	G5, T?	S5
Mertensia paniculata		Tall lungwort	G5	S5
Minuartia dawsonensis	*Arenaria stricta* ssp. *dawsonensis, Arenaria stricta* var. *dawsonensis, Arenaria dawsonensis, Arenaria stricta* var. *litoralis*	Rock stitchwort	G5	S5?
Minuartia rubella	*Arenaria rubella, Arenaria verna* var. *propinqua, Arenaria verna* var. *rubella*	Boreal sandwort	G5	S2
Monarda fistulosa		Wild bergamot	G5	S5
Monarda fistulosa ssp. *fistulosa*		Oswego-tea	G5, T?	S5
Moneses uniflora	*Pyrola uniflora, Moneses uniflora* ssp. *reticulata, Moneses uniflora* var. *reticulata*	One-flowered wintergreen	G5	S5
Muhlenbergia glomerata	*Muhlenbergia glomerata* var. *cinnoides, Muhlenbergia racemosa* var. *cinnoides*	Bog muhly	G5	S5
Muhlenbergia mexicana	*Agrostis mexicana, Muhlenbergia ambigua, Muhlenbergia foliosa, Muhlenbergia foliosa* ssp. *ambigua, Muhlenbergia foliosa* ssp. *setiglumis, Muhlenbergia mexicana* var. *filiformis*	Wood muhly	G5	SRF
Myrica gale	*Gale palustris, Myrica gale* var. *subarctica Myrica gale* var. *subglabra, Myrica gale* var. *tomentosa*	Sweet gale	G5	S5
Myriophyllum alterniflorum	*Myriophyllum alterniflorum* var. *americanum*	Alternate-flowered water-milfoil	G5	S1
Myriophyllum verticillatum	*Myriophyllum verticillatum* var. *intermedium, Myriophyllum verticillatum* var. *pectinatum, Myriophyllum verticillatum* var. *pinnatifidum*	Whorled water-milfoil	G5	S3

Flora (Vascular Plants) of the Taiga Shield Ecozone

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Myriophyllum spicatum	*Myriophyllum spicatum* var. *exalbescens*	Spiked water-milfoil	G?	S5
Neslia paniculata		Ball mustard	G?	SE
Nuphar lutea		Yellow pond-lily	G5	S?
Orthilia secunda	*Pyrola secunda*, *Orthilia secunda* ssp. *obtusata*, *Orthilia secunda* var. *obtusata*, *Pyrola secunda* ssp. *obtusata*, *Pyrola secunda* var. *obtusata*, *Ramischia elatior*, *Ramischia secunda*	One-sided wintergreen	G5	S5
Oxytropis campestris		Late yellow locoweed	G5	S5
Oxytropis deflexa		Reflexed locoweed	G5	S5
Oxytropis deflexa var. *sericea*	*Oxytropis deflexa* ssp. *sericea*, *Oxytropis deflexa* var. *parviflora*	Blue pendant-pod oxytrope	G5, T5	S5?
Oxytropis monticola	*Oxytropis campestris* ssp. *gracilis*, *Oxytropis campestris* var. *cervinus*, *Oxytropis campestris* var. *gracilis*, *Oxytropis gracilis*, *Oxytropis luteola*, *Oxytropis villosa*	Late yellow locoweed	G5?	S5?
Oxytropis sericea		Early yellow locoweed	G5	S5
Papaver rhoeas		Corn poppy	G?	SE
Parnassia kotzebuei	*Parnassia kotzebuei* var. *pumila*	Alpine grass-of-parnassus	G4	S1
Pedicularis labradorica		Labrador lousewort	G5	S2
Pedicularis lanceolata	*Pedicularis auriculata*, *Pedicularis pallida*, *Pedicularis virginica*	Swamp lousewort	G5	SRF
Pedicularis parviflora		Purple lousewort	G4	S?
Pellaea atropurpurea	*Pellaea canadensis*	Purple-stem or Canada cliffbrake	G5	SRF
Pellaea gastonyi		Gastony's cliffbrake	G2, G4	S1
Petasites frigidus		Coltsfoot	G5	S5
Petasites frigidus var. *nivalis*	*Petasites vitifolius*	Palmate-leaved coltsfoot	G5, T?	S5
Petasites frigidus var. *palmatus*	*Petasites palmatus*	Palmate-leaved coltsfoot	G5, T5	S5
Petasites sagittatus	*Petasites sagittatus*	Arrow-leaved coltsfoot	G5	S5
Phacelia franklinii		Franklin's scorpionweed	G5	S4?
Phegopteris connectilis	*Phegopteris polypodioides*, *Thelypteris phegopteris*	Long or narrow beech-fern	G5	S2
Picea glauca		White spruce	G5	S5

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Picea mariana		Black spruce	G5	S5
Pinguicula villosa		Hairy butterwort	G4	S2, S3
Pinguicula vulgaris	*Pinguicula vulgaris* var. *americana*	Common butterwort or bog-violet	G5	S2, S3
Pinus banksiana		Jackpine	G5	S5
Plantago eriopoda	*Plantago shastensis*	Saline plantain	G5	S5?
Platanthera obtusata	*Habenaria obtusata*, *Habenaria obtusata* var. *collectanea*, *Lysiella obtusata*, *Platanthera obtusata* ssp. *oligantha*	Small northern bog-orchid	G5	S5
Poa alpina	*Poa alpina* ssp. *vivipara*, *Poa alpina* var. *vivipara*, *Poa vivipara*	Alpine bluegrass	G5	S1
Poa compressa		Canada bluegrass	G?	SE
Poa glauca		White bluegrass	G5	S?
Poa glauca ssp. *glauca*	*Poa glauca* ssp. *conferta*, *Poa glauca* ssp. *glaucantha*, *Poa glauca* var. *conferta*, *Poa glauca* var. *laxiuscula*, *Poa glaucantha*, *Poa nascapiensis*, *Poa scopulorum*, *Poa X tormentuosa*	White bluegrass	G5, T?	S?
Poa glauca ssp. *rupicola*	*Poa glauca* var. *rupicola*, *Poa rupicola*, *Poa glauca* ssp. *glauca*	Timberline bluegrass	G5, T3, T5	S?
Poa pratensis		Kentucky bluegrass	G?	S?
Polygonum amphibium		Swamp persicaria	G5	S5
Polygonum arenastrum	*Polygonum aequale*, *Polygonum aviculare* var. *arenastrum*, *Polygonum montereyense*	Oval-leaf knotweed	G5?	SE
Polygonum aviculare	*Polygonum monspeliense*, *Polygonum aviculare* var. *vegetum*, *Polygonum heterophyllum*	Doorweed	G?	S?
Polygonum convolvulus		Wild buckwheat	G?	S?
Polygonum douglasii		Douglas knotweed	G5	S?
Polygonum persicaria		Lady's-thumb	G?	SHE
Polygonum viviparum	*Bistorta vivipara*, *Polygonum fugax*, *Polygonum macounii*, *Polygonum viviparum* var. *alpinum*, *Polygonum viviparum* var. *macounii*	Alpine bistort	G5	S1, S2
Populus balsamifera		Balsam poplar	G5	S?

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Populus tremuloides	*Populus aurea, Populus cercidiphylla, Populus x peyponifolia, Populus tremula ssp. tremuloides, Populus tremuloides var. aurea, Populus tremuloides var. cercidiphylla, Populus tremuloides var. intermedia, Populus tremuloides var. magnifica*	Trembling aspen	G5	S5
Populus x jackii		Balm-of-gilead	HYB	S?
Portulaca oleracea	*Portulaca neglecta, Portulaca oleracea ssp. granulato stellulata, Portulaca oleracea ssp. impolita, Portulaca oleracea ssp. nicaraguensis, Portulaca oleracea ssp. nitida, Portulaca oleracea ssp. papillatostellulata, Portulaca oleracea ssp. stellata*	Purslane	G7	SE
Potamogeton obtusifolius		Blunt-leaved pondweed	G5	S2
Potamogeton richardsonii	*Potamogeton perfoliatus ssp. richardsonii, Potamogeton perfoliatus var. richardsonii*	Richardson's pondweed	G5	S5
Potamogeton alpinus	*Potamogeton alpinus ssp. tenuifolius, Potamogeton alpinus var. subellipticus, Potamogeton alpinus var. tenuifolius*	Northern pondweed	G5	S?
Potamogeton gramineus	*Potamogeton gramineus var., graminifolius Potamogeton gramineus var. maximus, Potamogeton gramineus var. myriophyllus, Potamogeton gramineus var. typicus*	Various-leaved pondweed	G5	S5
Potamogeton pectinatus	*Stuckenia pectinata*	Sago pondweed	G5	S?
Potamogeton pusillus var. tenuissimus	*Potamogeton berchtoldii, Potamogeton berchtoldii var. acuminatus, Potamogeton berchtoldii var. colpophilus, Potamogeton berchtoldii var. lacunatus, Potamogeton berchtoldii var. macronatus, Potamogeton berchtoldii var. polyphyllus,*	Berchtold's pondweed	G5, T5	S2
Potentilla bipinnatifida	*Potentilla fissilora, Potentilla pensylvanica var. arida, Potentilla pensylvanica var. bipinnatifida*	Plains cinquefoil	G4, G5	S?
Potentilla flabellifolia		Mountain cinquefoil	G5	S?
Potentilla gracilis	*Potentilla gracilis var. gracilis*	Graceful cinquefoil	G5	S5
Potentilla hookeriana ssp. hookeriana	*Potentilla hookeriana var. emarginata, Potentilla nivea ssp. hookeriana*	Hooker's creeping cinquefoil	G4T?	S1
Potentilla hookeriana ssp. chamissonis	*Potentilla Chamissonis, Potentilla kuznetzovii, Potentilla nivea ssp. chamissonis*	Hooker's creeping cinquefoil	G4T?	S1

Flora (Vascular Plants) of the Taiga Shield Ecozone

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Potentilla multifida	*Potentilla bimunderum*	Cut-leaved cinquefoil	G5	S2
Potentilla nivea		Snow cinquefoil	G5	S?
Potentilla norvegica		Rough cinquefoil	G5	S5
Potentilla pensylvanica var. *litoralis*	*Potentilla pensylvanica* var. *glabrata*, *Potentilla litoralis*, *Potentilla pectinata*, *Potentilla pensylvanica* var. *pectinata*	Smooth or shore cinquefoil	G5, T?	S2, S3
Potentilla pulcherrima	*Potentilla gracilis* var. *Pulcherrima*, *Potentilla camporum*	Soft cinquefoil	G5	S?
Primula mistassinica	*Primula intercedens*, *Primula mistassinica* var. *intercedens*, *Primula mistassinica* var. *noveboracensis*	Bird's-eye primrose	G5	S3
Prunus virginiana var. *melanocarpa*	*Prunus melanocarpa*, *Padus melanocarpa*, *Padus virginiana* ssp. *melanocarpa*, *Prunus virginiana* ssp. *melanocarpa*	Choke cherry	G5, T?	S?
Puccinellia distans ssp. *hauptiana*	*Puccinellia hauptiana*	Haupt's alkali-grass	G5, T3, T4	S2
Pulsatilla patens ssp. *multifida*	*Anemone ludoviciana*, *Anemone multifida*, *Anemone nuttalliana*, *Anemone patens* var. *multifida*, *Anemone patens* var. *nuttalliana*, *Anemone patens* var. *wolfgangiana*, *Pulsatilla hirsutissima*, *Pulsatilla ludoviciana*, *Pulsatilla nuttalliana*	Pasque-flower	G5, T?	S5?
Pyrola asarifolia		Pink wintergreen	G5	S5
Pyrola grandiflora		Arctic wintergreen	G5	S?
Pyrola grandiflora var. *canadensis*	*Pyrola rotundifolia* ssp. *grandiflora*	Arctic wintergreen	G5, T?, Q	S1
Pyrola minor		Lesser wintergreen	G5	S5
Ranunculus acris		Tall buttercup	G5	SE
Ranunculus acris var. *acris*	*Ranunculus acris* ssp. *strigulosus*, *Ranunculus acris* var. *latisectus*, *Ranunculus acris* var. *stevenii*, *Ranunculus acris* var. *typicus*, *Ranunculus acris villosus*, *Ranunculus boreanus*	Tall buttercup	G5, T5	SE
Ranunculus aquatilis		Large-leaved water-crowfoot	G5	S?
Ranunculus circinatus		White water-crowfoot	G5	S?
Ranunculus lapponicus	*Coptidium lapponicum*	Lapland buttercup	G5	S5
Raphanus raphanistrum		Wild radish	G?	SE
Rheum rhaponticum	*Rheum rhabarbarum*	False rhubarb	G?	SE
Rhinanthus minor	*Rhinanthus crista-gali*	Yellow-rattle	G4	S2, S3

Flora (Vascular Plants) of the Taiga Shield Ecozone

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Ribes glandulosum	*Ribes prostratum, Ribes resinosum*	Skunk currant	G5	S5
Ribes hudsonianum		Northern black currant	G5	S5
Ribes hudsonianum var. *hudsonianum*		Northern black current	G5, T?	S?
Ribes lacustre	*Limnobotrya lacustris, Ribes lacustre* var. *parvulum, Ribes oxycanthoides* var. *lacustre*	Bristly black currant	G5	S5
Ribes oxyacanthoides	*Grossularia oxyacanthoides*	Canada gooseberry	G5	S5
Ribes triste	*Ribes rubrum* var. *alaskanum, Ribes rubrum* var. *propinquum, Ribes triste* var. *albinervium*	Swamp red currant	G5	S5
Rorippa palustris	*Rorippa islandica* vars.	Bog yellow cress	G5	S5?
Rosa acicularis		Prickly rose	G5	S5
Rosa arkansana		Low prairie rose	G5	S?
Rubus arcticus	*Rosa acaulis*	Northern blackberry	G5	S?
Rubus chamaemorus		Cloudberry	G5	S5
Rubus idaeus		Red raspberry	G5	S5
Rubus pubescens		Dewberry	G5	S5
Rubus x paracaulis	*Rubus pubescens* var. *paracaulis*		HYB	S?
Rumex pseudonatronatus	*Rumex fennicus*	Field dock	G?	SE
Rumex aquaticus		Western dock	G5	S?
Rumex crispus		Curled dock	G?	SE
Rumex maritimus	*Rumex fueginus, Rumex maritimus* ssp. *fueginus, Rumex maritimus* var. *athrix, Rumex maritimus* var. *fueginus, Rumex maritimus* var. *persicarioides, Rumex persicarioides*	Golden dock	G5	S5
Rumex stenophyllus		Narrow-leaved field dock	G?	SE
Ruppia cirrhosa	*Ruppia cirrhosa* ssp. *occidentalis, Ruppia maritima* var. *occidentalis, Ruppia maritima* var. *spiralis, Ruppia occidentalis, Ruppia spiralis*	Spiral ditch-grass	G5	S?
Sagina nodosa		Pearlwort	G5	S2
Sagina nodosa ssp. *borealis*	*Sagina nodosa* var. *borealis*	Knotted pearlwort	G5, TU	S2

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Salix arbusculoides	*Salix acutifolia, Salix humillima, Salix humillima* var. *puberula, Salix saskatchevana*	Shrubby willow	G5	S5
Salix arctophila	*Salix arctica, Salix arctophila* var. *lejocarpa, Salix groenlandica, Salix groenlandica* var. *lejocarpa*	Arctic willow	G5	S2
Salix bebbiana	*Salix bebbiana* var. *capreifolia, Salix bebbiana* var. *depilis, Salix bebbiana* var. *luxurians, Salix bebbiana* var. *perrostrata, Salix bebbiana* var. *projecta, Salix depressa* ssp. *rostrata, Salix livida* var. *occidentalis, Salix livida* var. *rostrata*	Beaked willow	G5	S5
Salix candida	*Salix candida* var. *denudata, Salix candida* var. *tomentosa, Salix candidula*	Hoary willow	G5	S5
Salix exigua	*Salix interior* var. *tenuifolia, Salix interior* var. *angustissima, Salix interior* var. *luteosericea, Salix argophylla, Salix exigua* var. *angustissima, Salix exigua* var. *columbiana, Salix exigua* var. *hindsiana, Salix exigua* var. *luteosericea*	Sandbar willow	G5	S5
Salix glauca		Smooth willow	G4	S5
Salix myrtillifolia	*Salix lingulata, Salix myrsinites* var. *curtiflora, Salix myrtillifolia* var. *curtiflora, Salix myrtillifolia* var. *lingulata, Salix novae-angliae* var. *myrtillifolia, Salix novae-angliae* var. *pseudocordata, Salix pseudocordata*	Myrtle-leaved willow	G5	S5
Salix pedicellaris	*Salix myrtilloides* var. *pedicellaris, Salix fuscescens* var. *hebecarpa, Salix hebecarpa, Salix myrtilloides* var. *hypoglauca, Salix pedicellaris* var. *hypoglauca, Salix pedicellaris* var. *tenuescens*	Bog willow	G5	S5
Salix pentandra		Bay-leaved willow	G?	SEC
Salix planifolia ssp. *planifolia*	*Salix chlorophylla, Salix chlorophylla* var. *monica, Salix chlorophylla* var. *nelsonii, Salix chlorophylla* var. *pychnocarpa, Salix monica, Salix nelsonii, Salix pennata, Salix phylicifolia* ssp. *planifolia, Salix phylicifolia* var. *monica, Salix phylicifolia*	Tea-leaf willow	G5, T5	S5

Flora (Vascular Plants) of the Taiga Shield Ecozone

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Salix pellita	*Salix cordata* var. *mackenzieana*, *Salix eriocephala* ssp. *mackenzieana*, *Salix eriocephala* var. *mackenzieana*, *Salix mackenzieana*, *Salix mackenzieana* var. *macrogemma*, *Salix rigida* ssp. *mackenzieana*, *Salix rigida* var. *mackenzieana*, *Salix rigida* var. *macrogemma*	Mackenzie's willow	G5	S?
Salix pyrifolia	*Salix balsamifera*, *Salix balsamifera* var. *alpestris*, *Salix balsamifera* var. *lanceolata*, *Salix balsamifera* var. *vegeta*, *Salix cordata* var. *balsamifera*, *Salix pyrifolia* var. *lanceolata*	Balsam willow	G5	S?
Salix reticulata		Net-leaf willow	G5	S2
Salix scouleriana	*Salix brachystachys*, *Salix brachystachys* var. *scouleriana*, *Salix capreoides*, *Salix flavescens*, *Salix flavescens* var. *capreoides*, *Salix flavescens* var. *scouleriana*, *Salix nuttallii* var. *capreoides*, *Salix scouleriana* var. *brachystachys*	Scouler willow	G5	S5
Sarracenia purpurea		Pitcher-plant	G5	S4?
Saxifraga tricuspidata	*Leptasea tricuspidata*	Three-toothed saxifrage	G4, G5	S?
Schizachyrium scoparium	*Andropogon scoparius* var. *scoparius*	Little bluestem	G5	S?
Schizachyrium scoparium ssp. *scoparium*	*Andropogon scoparius*, *Andropogon praematurus*, *Andropogon scoparius* var. *ducis*, *Andropogon scoparius* var. *frequens*, *Andropogon scoparius* var. *neomexicanus*, *Andropogon scoparius* var. *polycladus*, *Andropogon scoparius* var. *septentrionalis*	Little bluestem	G5, T?	S?
Scirpus fluviatilis	*Bolboschoenus fluviatilis*, *Schoenoplectus fluviatilis*	River bulrush	G5	S5
Scirpus microcarpus	*Scirpus microcarpus* var. *longispicatus*, *Scirpus microcarpus* var. *rubrotinctus*, *Scirpus rubrotinctus*	Small-fruited bulrush	G5	S5
Secale cereale	*Triticum cerale*, *Secale montanum*	Rye	G?	SEC
Selaginella rupestris	*Selaginella rupestre*	Ledge spike-moss	G5	S?
Selaginella selaginoides		Low spike-moss	G5	S2
Senecio congestus	*Cineraria congesta*, *Senecio congestus* ssp. *tonsus*, *Senecio congestus* var. *palustris*, *Senecio congestus* var. *tonsus*, *Senecio palustris*	Marsh ragwort	G5	S5
Senecio pauciflorus		Few-flowered ragwort	G4, G5	SR

Flora (Vascular Plants) of the Taiga Shield Ecozone

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Senecio pauperculus	*Packera paupercula*	Balsam groundsel	G5	S5?
Senecio plattensis	*Senecio pauperculus* var. *thompsoniensis*, *Packera plattensis*	Prairie ragwort or groundsel	G5	S3, S4
Senecio streptanthifolius	*Packera strepthanthifolia*	Northern groundsel	G5	S1, S2
Senecio vulgaris		Common groundsel	G?	SE5
Silene antirrhina		Sleepy catchfly	G5	S1, S2
Silene drummondii	*Lychnis drummondii*, *Lychnis pudica*	Drummond campion	G5	S4?
Sinapis arvensis	*Brassica kaber*	Wild mustard	G?	SE
Sisymbrium altissimum		Tumbling mustard	G?	SE
Sium suave	*Sium cicutifolium*, *Sium floridanum*, *Sium suave* var. *floridanum*	Water parsnip	G5	S5
Solanum ptychanthum	*Solanum americanum*, *Solanum nigrum*	Black nightshade	G5	S?
Solidago hispida		Hairy goldenrod	G5	S5?
Solidago multiradiata		Alpine goldenrod	G5	S5?
Solidago multiradiata var. *scopulorum*		Variety of alpine goldenrod	G5, T5	S5?
Solidago nemoralis		Showy goldenrod	G5	S5?
Solidago nemoralis var. *longipetiolata*	*Solidago nemoralis* var. *decemflora*, *Solidago decemflora*, *Solidago longipetiolata*, *Solidago nemoralis* ssp. *decemflora*, *Solidago nemoralis* ssp. *longipetiolata*, *Solidago pulcherrima*	Variety of showy goldenrod	G5, T5	S5?
Solidago simplex		Mt. Albert goldenrod	G5	S5
Sonchus arvensis		Perennial sow-thistle	G?	SE5
Sonchus arvensis ssp. *arvensis*	*Sonchus arvensis* var. *sibumovichii*	Field sow-thistle	G?, T?	SE5
Sonchus oleraceus		Annual sow-thistle	G?	SE5
Sorbus aucuparia		Rowan tree	G5	SE
Sorbus scopulina		Western mountain-ash	G5	S2
Sparganium americanum		American bur-reed	G5	S?
Sparganium hyperboreum		Northern bur-reed	G5	S1
Sparganium fluctuans		Floating bur-reed	G5	S2
Stellaria calycantha		Northern stitchwort	G5	S5?
Stellaria ciliatosepala	*Stellaria edwardsii*	Edward's starwort	G?	SRF?

Flora (Vascular Plants) of the Taiga Shield Ecozone

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Stellaria crassifolia		Fleshy stitchwort	G5	S5
Stellaria crassifolia var. *crassifolia*	*Alsine crassifolia*	Fleshy starwort	G5, T5	S5
Stellaria longipes var. *subvestita*	*Stellaria subvestita*	Hairy long-stalked stitchwort	G5, T?	S2
Subularia aquatica var. *americana*	*Subularia aquatica* ssp. *americana*	Water awlwort	G5, T5	S3
Symphyotrichum lanceolatum var. *hesperium*	*Aster hesperius, Aster hesperius* var. *laetevirens, Aster hesperius* var. *wootonii, Aster laetevirens, Aster lanceolatus* ssp. *hesperius, Aster osterhoutii, Aster wootonii, Symphyotrichum hesperium*	White panicled American-aster		S5
Syringa vulgaris		Common lilac	G?	SE
Taraxacum officinale		Dandelion	G5	S2, S5
Taraxacum officinale ssp. *ceratophorum*	*Taraxacum ceratophorum, Taraxacum ambigens, Taraxacum ambigens* var. *flutius, Taraxacum amphiphron, Taraxacum arctogenum, Taraxacum brachyceras, Taraxacum carthamopsis, Taraxacum dumetorum, Taraxacum eurylepium, Taraxacum hyperboreum, Taraxacum integratum*	Horned dandelion	G5, T5	S2
Taraxacum officinale ssp. *officinale*	*Taraxacum officinale* var. *palustre, Leontodon latiloba, Leontodon taraxacum, Taraxacum atroglaucum, Taraxacum campylodes, Taraxacum croceum, Taraxacum curvidens, Taraxacum cyclocentrum, Taraxacum dahlstedtii, Taraxacum davidssonii, Taraxacum devians*	Common dandelion	G5, T5	SE5
Thlaspi arvense		Stinkweed	G?	SE5
Tilia americana		Basswood	G5	SE1
Tofieldia glutinosa		Sticky asphodel	G5	S?
Tofieldia pusilla	*Narthecium pusillum, Tofieldia palustris*	Small false-asphodel	G5	S1
Torreyochloa pallida var. *fernaldii*	*Glyceria fernaldii, Glyceria pallida* var. *fernaldii, Puccinellia fernaldii, Torreyochloa fernaldii*	Pale manna grass	G5?, T4, Q	S2
Trientalis borealis		Northern starflower	G5	S?
Trifolium aureum	*Trifolium agrarium*	Yellow clover	G?	SE
Trifolium hybridum	*Trifolum elegans, Trifolium hybridum* ssp. *elegans, Trifolium hybridum* var. *elegans, Trifolium hybridum* var. *pratense*	Alsike clover	G?	SE

Flora (Vascular Plants) of the Taiga Shield Ecozone

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Trifolium pratense	*Trifolium pratense* var. *pratense*	Red clover	G?	SE
Trifolium repens		White clover	G?	SE
Triglochin maritimum	*Triglochin maritima*	Seaside arrow-grass	G5	S5
Triglochin palustre		Marsh arrow-grass	G5	S5
Trimorpha acris	*Erigeron acris*	Northern daisy fleabane or bitter fleabane	G5	S5?
Trimorpha acris var. *asteroides*	*Erigeron acris* ssp. *politus*, *Erigeron acris* var. *asteroides*	Variety of northern daisy fleabane or bitter fleabane	G5, T5	S5?
Trimorpha elata	*Erigeron elatus*, *Erigeron acris* var. *elatus*	Tall white fleabane	G4?	S2
Trimorpha lonchophylla	*Erigeron lonchophyllus*, *Erigeron lonchophyllus* var. *laurentianus*, *Erigeron minor*	Hirsute or spear-leaved fleabane	G5	S5
Trisetum spicatum	*Trisetum subspicatum*, *Aira spicata*, *Trisetum montanum*, *Trisetum montanum* var. *shearii*, *Trisetum spicatum* ssp. *alaskanum*, *Trisetum spicatum* ssp. *congdonii*, *Trisetum spicatum* ssp. *majus*, *Trisetum spicatum* ssp. *molle*, *Trisetum spicatum* ssp. *montanum*	Spike trisetum or narrow false oats	G5	S2
Utricularia intermedia		Flat-leaved bladderwort	G5	S5
Utricularia minor		Lesser bladderwort	G5	S2, S3
Vaccinium cespitosum		Dwarf bilberry	G5	S4?
Vaccinium cespitosum var. *cespitosum*		Dwarf blueberry	G5, T?	S4?
Vaccinium oxycoccos	*Oxycoccus hagerupii*, *Oxycoccus intermedius*, *Oxycoccus microcarpus*, *Oxycoccus ovalifolius*, *Oxycoccus oxycoccus*, *Oxycoccus palustris*, *Oxycoccus palustris* ssp. *microphyllus*, *Oxycoccus palustris* var. *intermedius*, *Oxycoccus palustris* var. *ovalifolius*	Small cranberry	G5	S5
Vaccinium uliginosum	*Vaccinium occidentale*, *Vaccinium uliginosum* ssp. *alpinum*, *Vaccinium uliginosum* ssp. *gaultherioides*, *Vaccinium uliginosum* ssp. *occidentale*, *Vaccinium uliginosum* ssp. *pedris*, *Vaccinium uligino sum* ssp. *pubescens*, *Vaccinium uliginosum* var. *alpinum*	Bog whortleberry	G5	S4?
Vaccinium vitis-idaea ssp. *minus*	*Vaccinium vitis-idaea* var. *minus*, *Vaccinium vitis-idaea* var. *punctatum*	Mountain cranberry	G5, T5	S5
Vaccinium vitis-idaea		Bog cranberry	G5	S5
Veronica peregrina		Purslane speedwell	G5	S?

Flora (Vascular Plants) of the Taiga Shield Ecozone

Scientific Name	Scientific Synonyms	Common Name	Global Status	Provincial Status
Veronica scutellata	*Veronica scutellata* var. *villosa*	Marsh speedwell	G5	S5
Viburnum edule	*Viburnum pauciflorum*	Low bush-cranberry	G5	S5
Vicia americana		American vetch	G5	S5
Vicia cracca	*Vicia semicincta*	Tufted vetch	G?	SE
Viola adunca		Early blue violet	G5	S5
Viola labradorica	*Viola adunca* var. *minor*, *Viola conspersa*	Labrador violet	G5	S1
Viola palustris		Marsh violet	G5	S5
Viola tricolor		Pansy	G?	SE
Woodsia glabella		Smooth woodsia	G5	S2
Woodsia ilvensis		Rusty woodsia	G5	S5
Woodsia oregana		Western cliff fern	G5	S2
Woodsia oregana ssp. *oregana*	*Woodsia oregana* var. *oregana*	Oregon woodsia	G5, T4?	S2
Woodsia scopulina	*Woodsia oregana* var. *lyalii*	Rocky mountain woodsia	G5	S1

Source: Conservation Data Centre, SERM

Note: This appendix may be incomplete due to the lack of data from the Taiga Shield Ecozone.

Appendix 5

Fauna of the Taiga Shield Ecozone

(*Note:* See Appendix 3 for status codes and modifiers)

Scientific Name	Common Name	Global Status	Provincial Status	COSEWIC
Accipiter gentilis	Northern goshawk	G5	S4B, SZN	
Accipiter striatus	Sharp-shinned hawk	G5	S4B, SZN	Not in any category (1986)
Actitis macularia	Spotted sandpiper	G5	S5B, SZN	
Aegolius funereus	Boreal owl	G5	S4B, S4N	
Agelaius phoeniceus	Red-winged blackbird	G5	S5B, SZN	
Alces alces	Moose	G5	S5	
Alopex lagopus	Arctic fox	G5	S3	
Anas acuta	Northern pintail	G5	S5B, SZN	
Anas americana	American wigeon	G5	S5B, SZN	
Anas clypeata	Northern shoveler	G5	S5B, SZN	
Anas crecca	Green-winged teal	G5	S5B, SZN	
Anas discors	Blue-winged teal	G5	S5B, SZN	
Anas platyrhynchos	Mallard	G5	S5B, S4N	
Aquila chrysaetos	Golden eagle	G5	S4B, SZN	
Asio flammeus	Short-eared owl	G5	S4B, S2N	
Aythya affinis	Lesser scaup	G5	S5B, SZN	
Aythya marila	Greater scaup	G5	SAB, S5N	
Aythya valisineria	Canvasback	G5	S5B, SZN	
Bombycilla cedrorum	Cedar waxwing	G5	S5B, SZN	
Bombycilla garrulus	Bohemian waxwing	G5	S4B, SZN	
Bonasa umbellus	Ruffed grouse	G5	S5B, SZN	
Botaurus lentiginosus	American bittern	G4	S4B, SZN	
Branta canadensis	Canada goose	G5	S5B, SZN	
Bucephala albeola	Bufflehead	G5	S5B, SZN	
Bucephala clangula	Common goldeneye	G5	S5B, SZN	
Buteo jamaicensis	Red-tailed hawk	G5	S5B, SZN	
Buteo lagopus	Rough-legged hawk	G5	SAB, S5N	
Buteo swainsoni	Swainson's hawk	G5	S4B, SZN	
Calcarius lapponicus	Lapland longspur	G5	SZB?, S5N	
Calidris melanotos	Pectoral sandpiper	G5	SZB, S5N	
Calidris minutilla	Least sandpiper	G5	SZB?, S4N	
Canis lupus	Gray wolf	G4	S4	Not at Risk (1999)
Carduelis flammea	Common redpoll	G5	S4B, S4N	
Carduelis hornemanni	Hoary redpoll	G5	SZB, S5N	
Carpodacus purpureus	Purple finch	G5	S5B, SZN	
Castor canadensis	Beaver	G5	S5	
Catharus fuscescens	Veery	G5	S5B, SZN	

Fauna of the Taiga Shield Ecozone

Scientific Name	Common Name	Global Status	Provincial Status	COSEWIC
Catharus guttatus	Hermit thrush	G5	S4B, SZN	
Catharus minimus	Gray-cheeked thrush	G5	S4B, SZN	
Catharus ustulatus	Swainson's thrush	G5	S5B, SZN	
Catostomus catostomus	Longnose sucker	G5	S5	
Catostomus commersoni	White sucker	G5	S5	
Certhia americana	Brown creeper	G5	S4B, S3N	
Charadrius semipalmatus	Semipalmated plover	G5	S1B, SZN	
Charadrius vociferus	Killdeer	G5	S5B, SZN	
Chen rossii	Ross' goose	G4	SZB, SZN	
Chlidonias niger	Black tern	G4	S4B, SZN	
Circus cyaneus	Northern harrier	G5	S5B, SZN	Not in any category (1993)
Clangula hyemalis	Oldsquaw	G5	SAB, S5N	
Clethrionomys gapperi	Red-backed vole	G5	S5	
Colaptes auratus	Northern flicker	G5	S5B, SZN	
Contopus cooperi	Olive-sided flycatcher	G5	S5B, SZN	
Coregonus artedi	Cisco or lake herring	G5	S5	
Coregonus clupeaformis	Lake whitefish	G5	S5	
Coregonus zenithicus	Shortjaw cisco	G2	S1	Threatened (1987)
Corvus corax	Common raven	G5	S5B, SZN	
Cottus cognatus	Slimy sculpin	G5	S5	
Cottus ricei	Spoonhead sculpin	G5	S5	Not in any category (1988)
Couesius plumbeus	Lake chub	G5	S5	
Cygnus columbianus	Tundra swan	G5	S1B,SZN	
Dendroica coronata	Yellow-rumped warbler	G5	S5B, SZN	
Dendroica palmarum	Palm warbler	G5	S5B, SZN	
Dendroica petechia	Yellow warbler	G5	S5B, SZN	
Dendroica striata	Blackpoll warbler	G5	S5B, SZN	
Dryocopus pileatus	Pileated woodpecker	G5	S4B, S3N	
Eremophila alpestris	Horned lark	G5	S5B, SZN	
Esox lucius	Northern pike	G5	S5	
Euphagus carolinus	Rusty blackbird	G5	S5B, SZN	
Falcipennis canadensis	Spruce grouse	G5	S5B, SZN	
Falco columbarius	Merlin	G5	S4B, SZN	Not in any category (1985)
Falco rusticolus	Gyrfalcon	G5	SZB, S5N	Not in any category (1987)
Falco sparverius	American kestrel	G5	S5B, SZN	
Felis concolor	Cougar	G5	S2, S3	(East Pop) Endangered (1978); [redacted] (1998)
Gallinago gallinago	Common snipe	G5	S5B, SZN	
Gavia immer	Common loon	G5	S5B, SZN	
Gavia pacifica	Pacific loon	G5	SAB, SZN	
Gavia stellata	Red-throated loon	G5	S1B, SZN	
Geothlypis trichas	Common yellowthroat	G5	S5B, SZN	
Glaucomys sabrinus	Northern flying squirrel	G5	S5	
Grus canadensis	Sandhill crane	G5	S4B, S5N	
Gulo gulo	Wolverine	G4	S3, S4	Vulnerable (1988)

Fauna of the Taiga Shield Ecozone

Scientific Name	Common Name	Global Status	Provincial Status	COSEWIC
Haliaeetus leucocephalus	Bald eagle	G4	S4B, SZN	Not in any category (1984)
Aliaeetus alcicidus	Goldeye	G5	S4, S5	
Hirundo rustica	Barn swallow	G5	S5B, SZN	
Histrionicus histrionicus	Harlequin duck	G4	SZB, SAN	
Junco hyemalis	Dark-eyed junco	G5	S5B, SZN	
Lagopus lagopus	Willow ptarmigan	G5	SAB, S5N	
Lagopus mutus	Rock ptarmigan	G5	SZB, SAN	
Lanius excubitor	Northern shrike	G5	S1B, SZN	
Larus argentatus	Herring gull	G5	S5B, SZN	
Larus californicus	California gull	G5	S5B, SZN	
Larus canus	Mew gull	G5	S4B, SZN	
Larus delawarensis	Ring-billed gull	G5	S5B, SZN	
Larus hyperboreus	Glaucous gull	G5	SZB, SAN	
Larus philadelphia	Bonaparte's gull	G5	S4B, SZN	
Lasiurus borealis	Eastern red bat	G5	S5B, SZN	
Lasiurus cinereus	Hoary bat	G5	S5B, SZN	
Lepus americanus	Snowshoe hare	G5	S5	
Lota lota	Burbot	G5	S5	
Loxia curvirostra	Red crossbill	G5	S4B, S5N	
Loxia leucoptera	White-winged crossbill	G5	S4B, S3N	
Lutra canadensis	River otter	G5	S5	
Lynx canadensis	Lynx	G5	S5	
Margaritifera margarita	Pearl dace	G5	S5	
Martes americana	Marten	G5	S5	
Martes pennanti	Fisher	G5	S4, S5	
Melanitta fusca	White-winged scoter	G5	S5B, SZN	
Melanitta perspicillata	Surf scoter	G5	S4B, SZN	
Melospiza lincolnii	Lincoln's sparrow	G5	S5B, SZN	
Melospiza melodia	Song sparrow	G5	S5B, SZN	
Mergus merganser	Common merganser	G5	S5B, SZN	
Mergus serrator	Red-breasted merganser	G5	S5B, SZN	
Microtus pennsylvanicus	Meadow vole	G5	S5	
Microtus xanthognathus	Yellow-cheeked or taiga vole	G5	S5	
Mustela erminea	Ermine, short-tailed weasel	G5	S5	
Mustela nivalis	Least weasel	G5	S5	
Mustela vison	Mink	G5	S5	
Myotis lucifugus	Little brown bat	G5	S5B, S?N	
Myoxocephalus thompsoni	Deepwater sculpin	G5	S5	Threatened (1987)
Notropis atherinoides	Emerald shiner	G5	S5	
Notropis hudsonius	Spottail shiner	G5	S5	
Ondatra zibethicus	Muskrat	G5	S5	
Pandion haliaetus	Osprey	G5	S4B, SZN	
Passer domesticus	House sparrow	G5	SE	
Passerella iliaca	Fox sparrow	G5	S5B, SZN	
Perca flavescens	Yellow perch	G5	S5	

Fauna of the Taiga Shield Ecozone

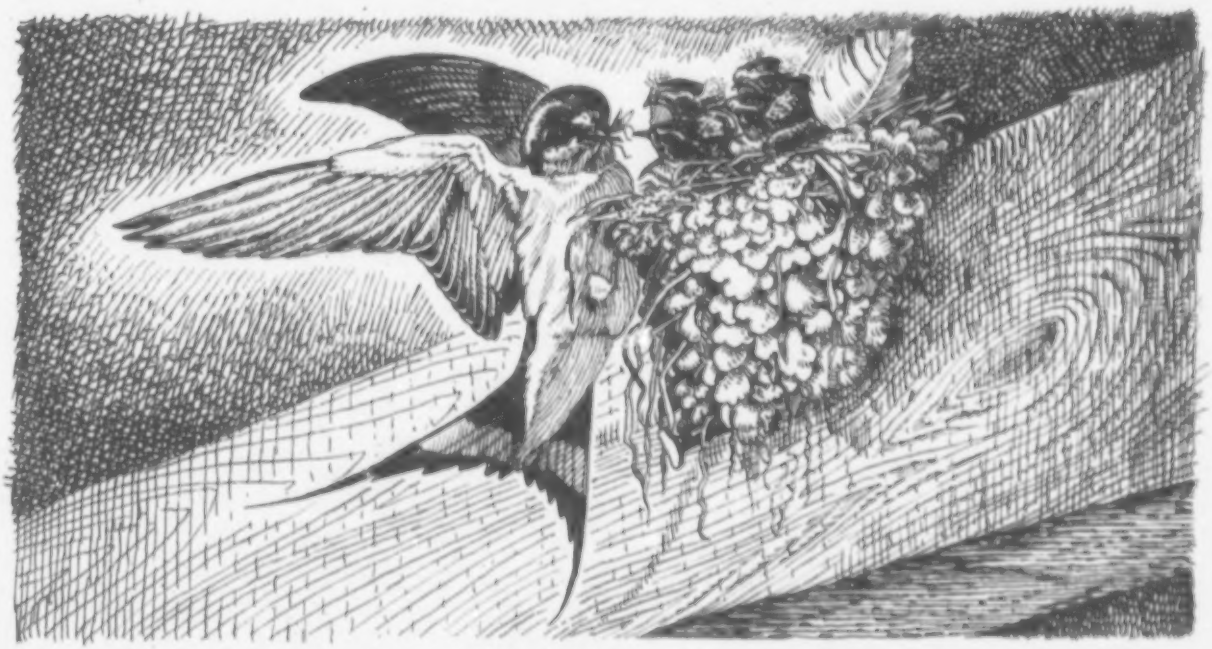
Scientific Name	Common Name	Global Status	Provincial Status	COSEWIC
Percopsis omiscomaycus	Trout-perch	G5	S5	
Perisoreus canadensis	Gray jay	G5	S5B, S5N	
Peromyscus maniculatus	Deer mouse	G5	S5	
Petrochelidon pyrrhonota	Cliff swallow	G5	S5B, SZN	
Phalaropus lobatus	Red-necked phalarope	G5	SZB?, S4N	
Phenacomys intermedius	Heather vole	G5	S5	
Pica pica	Black-billed magpie	G5	S5B, S5N	
Picoides arcticus	Black-backed woodpecker	G5	S4B, S3N	
Picoides tridactylus	Three-toed woodpecker	G5	S4B, S3N	
Picoides villosus	Hairy woodpecker	G5	S5B, S5N	
Pinicola enucleator	Pine grosbeak	G5	S2B, S4N	
Plectrophenax nivalis	Snow bunting	G5	SZB,S5N	
Podiceps grisegena	Red-necked grebe	G5	S5B, SZN	Not in any category (1982)
Poecile atricapillus	Black-capped chickadee	G5	S5B, S5N	
Poecile hudsonicus	Boreal chickadee	G5	S5B, S5N	
Prosopium cylindraceum	Round whitefish	G5	S5	
Pseudacris triseriata	Boreal chorus frog	G5	S5	
Pungitius pungitius	Ninespine stickleback	G5	S5	
Rana pipiens	Northern leopard frog	G5	S3	
Rana sylvatica	Wood frog	G5	S4	
Rangifer tarandus caribou	Woodland caribou	G5	S3	
Rangifer tarandus groenlandicus	Barren-ground caribou	G5	S3	Vulnerable (1984)
Regulus calendula	Ruby-crowned kinglet	G5	S5B, SZN	
Salvelinus namaycush	Lake trout	G5	S5	
Sayornis phoebe	Eastern phoebe	G5	S5B, SZN	
Seiurus noveboracensis	Northern waterthrush	G5	S5B, SZN	
Sitta canadensis	Red-breasted nuthatch	G5	S5B, S5N	
Sorex arcticus	Arctic shrew	G5	S5	
Sorex cinereus	Masked shrew	G5	S5	
Sorex hoyi	Pygmy shrew	G5	S5	
Sorex palustris	Water shrew	G5	S5	
Spizella arborea	American tree sparrow	G5	S5B, SZN	
Spizella passerina	Chipping sparrow	G5	S5B, SZN	
Stercorarius parasiticus	Parasitic jaeger	G5	SZB, SAN	
Sterna hirundo	Common tern	G5	S5B, SZN	Not at Risk (1998)
Sterna paradisaea	Arctic tern	G5	S4B, SZN	
Stizostedion vitreum	Walleye	G5	S5	
Surnia ulula	Northern hawk-owl	G5	S3B, S5N	
Synaptomys borealis	Northern bog lemming	G4	S4	
Tachycineta bicolor	Tree swallow	G5	S5B, SZN	
Tamias minimus	Least chipmunk	G5	S5	
Tamiasciurus hudsonicus	Red squirrel	G5	S5	
Thymallus arcticus	Arctic grayling	G5	S5	
Toxostoma rufum	Brown thrasher	G5	S5B, SZN	
Tringa flavipes	Lesser yellowlegs	G5	S5B, SZN	

Fauna of the Taiga Shield Ecozone

Scientific Name	Common Name	Global Status	Provincial Status	COSEWIC
Tringa melanoleuca	Greater yellowlegs	G5	S5B, SZN	
Tringa solitaria	Solitary sandpiper	G5	S5B, SZN	
Troglodytes troglodytes	Winter wren	G5	S4B, SZN	
Turdus migratorius	American robin	G5	S5B, SZN	
Tympanuchus phasianellus	Sharp-tailed grouse	G4	S5B, S5N	
Tyrannus tyrannus	Eastern kingbird	G5	S5B, SZN	
Ursus americanus	Black bear	G5	S5	Not at risk (1998); Not at risk (1999)
Vermivora celata	Orange-crowned warbler	G5	S5B, SZN	
Vermivora peregrina	Tennessee warbler	G5	S5B, SZN	
Vireo olivaceus	Red-eyed vireo	G5	S5B, SZN	
Vireo solitarius	Solitary vireo	G5	S5B, SZN	
Vulpes vulpes	Red fox	G5	S5	
Zapus hudsonius	Meadow jumping mouse	G5	S5	
Zonotrichia albicollis	White-throated sparrow	G5	S5B, SZN	
Zonotrichia leucophrys	White-crowned sparrow	G5	S5B, SZN	
Zonotrichia querula	Harris' sparrow	G5	S5B, SZN	

Source: Conservation Data Centre, SERM

Note: This appendix may be incomplete due to the lack of data from the Taiga Shield Ecozone.



Barn Swallow

Appendix 6

Climate Change Initiatives

The world's climate is changing. Canada, like countries throughout the world, is concentrating on how to reduce the greenhouse gas emissions that are accumulating in our atmosphere, to prevent or slow future climate change and to adapt to climate change.

Saskatchewan is supporting the five major components of Canada's National Implementation Strategy on Climate Change. They are:

1. Encouraging Action
2. Promoting Technology Development and Innovation
3. Enhancing Awareness and Understanding
4. Governments Leading by Example
5. Investing in Knowledge and Building the Foundation

This is not a complete listing of climate change programs and initiatives in Saskatchewan. Many municipal governments, institutions, businesses and non-governmental organizations are dedicating resources to reducing greenhouse gas emissions. New ideas and approaches to this major global problem are coming to light as both government and private sector efforts to address the problem intensify. SERM's web site (www.serm.gov.sk.ca/environment/) provides links to these organizations and to other climate change sites in Canada and throughout the world.

Fisher

Appendix 7

Status of Saskatchewan Furbearers

ORDER Family	Species	Common Name	Provincial Status
RODENTIA			
Castoridae	*Castor canadensis*	beaver	Population is large with an increasing growth trend in the Prairie and Boreal Plain ecozones, due to reduced trapping pressure (decline in number of trappers). Nuisance beaver complaints are common throughout range.
Cricetidae	*Ondatra zibethicus*	muskrat	Population is large with an increasing growth trend following drought conditions in the late 1980s and early 1990s.
Sciuridae	*Tamiasciurus hudsonicus*	red squirrel	Population is large, stable and not at risk.
CARNIVORA			
Mustelidae	*Mustela erminea*	ermine	*M. erminea* accounts for 95% of the pelts marketed by forest trappers.
	Mustela frenata	long-tailed weasel	*M. frenata* is primarily trapped in the Aspen Parkland Ecoregion.
	Mustela rixosa	least weasel	*M. rixosa* occupies the boreal forest, but when captured accidentally is usually discarded because of the small size. Populations are stable and not at risk.
	Mustela vison	mink	Population is not at risk. Population growth trend is stable following an increase due to recovery from drought conditions of the late 1980s/early 1990s.
	Martes americana	marten	Population is large, but in downward trend, following a large population growth trend from the mid-1970s to late 1980s.
	Martes pennanti	fisher	Population is large and stable, following a population growth trend from the mid-1970s to late 1980s.
	Lutra canadensis	river otter	Declines in eastern Canada and the U.S. in late 1970s resulted in otter being listed under Convention on International Trade and Endangered Species (CITES). Saskatchewan population is stable. They are not a sought-after furbearer.
	Gulo gulo	wolverine	Populations are characteristically low but stable. Information is very limited on population status.
	Taxidea taxus	badger	Population is stable and not at risk.
	Mephitis mephitis	striped skunk	Population is stable and not at risk.

Status of Saskatchewan Furbearers

ORDER Family	Species	Common Name	Provincial Status
Canidae	*Canus lupus*	gray/timber wolf	Population is stable at 3,000-4,500 and is not at risk. Growth trend is increasing in forest fringe areas.
	Canus latrans	coyote	Population is large, stable and not at risk. There are numerous problem coyote complaints annually. Population is decreasing in the Aspen Parkland Ecoregion.
	Vulpes vulpes	colored fox (red, cross, silver)	Population is stable and not at risk.
	Alopex lagopus	arctic fox	The only truly migratory furbearer in Saskatchewan. Population is stable and not at risk.
Felidae	*Lynx canadensis*	lynx	Population is large and in an upward trend growth cycle. Listed under CITES, mainly to protect similar species in other countries, but is not at risk in Saskatchewan.
	Lynx rufus	bobcat	Population is stable and not at risk.
Ursidae	*Ursus americanus*	black bear	Population is stable at 24,000-30,000 and is not at risk. Listed under CITES as endangered to curb the international sale of bear parts from endangered bear species that are indistinguishable from Canadian black bears.
Procyonidae	*Procyon lotor*	raccoon	Population is low, limited by boreal climate, but stable and not at risk.

Source: SERM

Mink

Appendix 8

Species-at-Risk Legislation

Species-at-Risk Legislation

In 1997, Saskatchewan amended *The Wildlife Act* to designate, protect and recover species-at-risk and associated habitat. A new definition of wild species was added to include all wild organisms to provide the mandate for the protection of all plants and animals. The amendments protect endangered species through facilitating a cooperative approach with landowners and conservation organizations, increased educational awareness and support for species-at-risk recovery programs.

Provisions in the act allow for the preparation and implementation of recovery plans to protect and conserve wild species-at-risk and create a legal designation and listing of extirpated, endangered, threatened and vulnerable species based on scientific information. The act makes it illegal to kill, capture, harvest, traffic in, or export wild species-at-risk.

Habitats for species are also legislatively protected on Crown lands through *The Wildlife Habitat Protection Act*. Stewardship initiatives and purchase programs like the Fish and Wildlife Development Fund will assist in protecting species and their habitats on privately owned lands.

Two committees have been established, the Scientific Working Committee and the Endangered Species Advisory Committee, to review and advise on assessment and designation of species-at-risk in Saskatchewan. Implementation of recovery plans and associated activities is immediate upon the designation of endangered and threatened species under the *Wild Species-at-Risk Regulations*. The first group of provincial species-at-risk, listed in 1999, is shown in the following table.

Species	Common Name
Extirpated	
Animal Species	
Mustela nigripes	black-footed ferret
Ursus arctos horribilus	grizzly bear
Tympanuchus cupido	greater prairie chicken
Numenius borealis	Eskimo curlew
Plant Species	
Cypripedium canadium	small white lady's slipper
Endangered	
Animal Species	
Speotyto cunicularia	burrowing owl
Charadrius melodus	piping plover
Centrocercus urophasianus	sage grouse
Grus americana	whooping crane
Vulpes velox	swift fox
Plant Species	
Abronia micrantha	sand verbena
Tradescanthia occidentalis	western spiderwort
Cryptantha minima	tiny cryptanthe
Dalea villosa	hairy prairie-clover
Threatened	
Plant Species	
Halimolobos virgata	slender mouse-ear-cress

Appendix 9

List of Abandoned Underground Exploration/Mining Sites in the Taiga Shield Ecozone

Mine Company	Mine Name *	Location	Latitude	Longitude	Site Development **	Remedial Work Conducted/ Current Site Status
Amax Athabasca Uranium Mines Limited	Showing No. 50-CC1-61	South of Bertha Lake	59-33	108-42	Short adit developed. May have residual ore on site.	Adit plugged and sealed in 1979/80. Site assessment conducted in 2000.
Amax Athabasca Uranium Mines Limited	Showing No. 50-CC1-39	Bertha Lake Area	59-33	108-42	Surface trench.	Site assessment conducted in 2000.
Baska Uranium Mines Limited	Dot Claims, Zone 103	Virgin Lake Area	59-37-00 to 38-10	108-26-20 to 27-50	2 openings. Ore probably remains on site.	1 adit and 1 raise open. Inspected in 1977-78.
Black Bay Uranium Mines Ltd.	Black Bay Uranium Mine	Murmac Bay Area	59-29-25 to 30-30	108-27-00 to 31-45	2 raises, 1 trench and 1 adit.	Openings fenced and sealed with a drill steel/chain link fence grate. Site assessment conducted in 2000.
Caba Uranium Mines Limited		Tazin Lake - Dewdney Island	59-47-27	108-54-30		Small shaft on lake edge.
Cayzor Athabasca Mines Limited	Cayzor Mine	Jean Lake	59-34-35	108-38-20	1 main shaft.	Surface debris, including steel and a generator, spread around site. Waste rock pile on site. Site assessment conducted in 2000.
Consolidated Beta Gamma Mines Limited/Lavent Mines Limited	Beta Gamma Mine (Chum Claims, Zones 1 and 2)	Bellegarde Lake Area	59-35-30 to 37-00	108-38 to 40	1 shaft. 500 to 1000 tonnes of waste rock at the site.	Small shaft opening. Inspected in 1977-78. Site assessment conducted in 2000.
Consolidated Beta Gamma Mines Limited	Tena Claims	Lake Athabasca - Island Bay Area	59-32-00 to 32-30	109-03-20 to 05-00	Surface trenches. 1 prospect pit. 1 mine shaft.	2 openirgs on surface. Inspected in 1977-78.
Consolidated Nicholson Mines Limited	Zones 1, 2 and 4	Nicholson Bay Area	59-27-10 to 27-45	108-25-10 to 26-15	Three separate sites. A shaft was developed at each site.	Remedial work conducted in 1989. Steel grate used to secure 2 vertical raises as well as 1 adit. 3 shafts capped with concrete and 2 adits covered with rock.
***Cameco	Box Mine	Lake Athabasca - near Neiman Bay	59-27	108-29	Gold mine. Underground development. Structures and debris on site.	Site in need of reclamation and decommissioning. New mine development plan undergoing Environmental Assessment.

List of Abandoned Underground Exploration/Mining Sites in the Taiga Shield Ecozone

Mine Company	Mine Name *	Location	Latitude	Longitude	Site Development **	Remedial Work Conducted/ Current Site Status
Don Henry Mines Limited		Gatzke Lake Area	59-43-30 to 44-30	108-31 to 33		Inspected in 1999. 1 open adit. Steel debris and 205 L (45 gal) drums on site.
***Eldorado Nuclear Limited	Beaverlodge (Ace-Fay, Verna, Dubyna, Hab, Bolger, Martin Lake, Eagle, Shaft Lake and Bar 5-9 Claims)	Beaverlodge Lake Area	59-32 to 35	108-23 to 36	Shafts, structures, waste rock and tailings.	In decommissioning mode, Cameco is administrator.
***Eldorado Nuclear Limited/ Black Bay Uranium Mines Ltd.	Fish Hook Bay Mine	Fish Hook Bay Area	59-26	108-25	At least 1 shaft and 1 adit developed.	In decommissioning mode, Cameco is administrator.
Gulch Mines Limited	Gulch Mine (Gulch Zone)	Lake Athabasca - Grunchy Point	59-25-00 to 28-30	108-47-30 to 55-20	1 main site. Possibly other small sites. At least 1 adit.	Open adit on the side of a cliff. Debris on the surface. Site assessment conducted in 2000.
Gunnar Mining Limited	Gunnar Mine	Lake Athabasca	59-23-11	108-52-48	Open pit and underground mining.	Federal/provincial negotiations are underway for clean-up. Public safety, radiation and chemical environmental hazards. Tailings, waste rock and buildings remain at the site.
Homer Yellowknife Mines Limited and Nu-Age Uranium Mines Ltd.		Mathew Lake Area	59-26-45	107-47-25	Unknown development.	
Jesko Uranium Mines Limited	Car Claims, Showing No. 50-NN-31	Lake Athabasca - Griffth Bay	59-30-50 to 32-30	108-48-30 to 50-30	1 inclined prospect/ mine shaft developed.	Approximately 4.5 m to water. May not be a public safety hazard.
Lake Cinch Mines Limited	Lake Cinch Mine and River Zone (Cenex Property)	Cinch Lake Area	59-32-32	108-40-02	2 sites. At least 1 shaft at the Chinch Mine. At least 1 entrance at the River Zone site.	Remedial work conducted in 1989. 3 shafts filled with crushed rock and sealed with grates. 1 fuel tank and bridge remain. Crushed ore stockpile present. Site assessment conducted in 2000.
Lorado Uranium Mines Ltd.	Lorado (Mill Site)	Nero Lake	59-31-33	108-41-45	Milling site.	Federal/provincial negotiations are underway for clean-up. Some remaining radioactive and chemical hazards to environment. Tailings and some foundations remain.

List of Abandoned Underground Exploration/Mining Sites in the Taiga Shield Ecozone

Mine Company	Mine Name *	Location	Latitude	Longitude	Site Development **	Remedial Work Conducted/ Current Site Status
Lorado Uranium Mines Ltd.	Lorado (Mine Site)	Beaverlodge Lake - Hanson Bay	59-29-33	108-39-18	Underground mining. 1 main shaft. Waste rock.	Site assessment conducted in 2000.
Meta Uranium Mines Limited		Beaverlodge Lake - Umisk Island	59-31-46	108-29-03	1 adit and 1 shaft. Surface exploration also conducted.	Openings fenced and sealed with a drill steel/ chain link fence grate. Site assessment conducted in 2000.
National Explorations Limited	National Explorations Mine (Pat Claims, C Zone and Keiller Adit)	Donoldson Lake Area	59-36	108-27	1 main shaft and at least 1 adit. Raises filled with rock.	In 1994/95 cement used to secure main shaft and Keiller adit not filled and remains open. Site assessment conducted in 2000.
Nesbitt Mining and Exploration Limited		Reed Bay Area	59-29-56	109-06-10		1 open adit. Fuel tank and generator on site. Site assessment conducted in 2000.
Nesbitt Labine Uranium Mines Limited	Eagle Mine	Eagle Lake Area	59-34-28	108-29-23	1 shaft and 2 adits.	Remedial work conducted in 1989. Openings filled with rock. Some slumping in area of old shaft or vent raise. Site assessment conducted in 2000.
Nesbitt Labine Uranium Mines Limited	ABC Mine	Melville Lake	59-34-09	108-32-06	2 sites. 1 shaft and 1 adit. Surface trenches developed.	Remedial work conducted in 1989. Adit entrance filled with rock. Shaft secured. Adit now open.
New Mylamaque Explorations Limited		Tazin Lake - Liard Island	59-47-00	109-05-30		1 open adit.
Nisto Mines Limited	Nisto Mine	Black Lake - Fir Island - Chicken Reserve #226	59-13-15	105-25-45	2 main adits and stope.	Site rehabilitation completed in 1999.
North Shore U Developers		Lake Athabasca - Island Bay Area			High grade ore mining by Consolidated Beta Gamma Mines Ltd. site. Surface trenches.	Inspected in 1977-78.
Pitch-Ore Uranium Mines Limited/ Albex Minerals		Martin Lake Area	59-31-30 to 32-30	108-32-30 to 34-30	2 adits and 1 main trench.	Adit and raise sealed in the 1950s/60s. Remedial work conducted in 1989. Adit sealed with crushed rock. Site assessment conducted in 2000.

List of Abandoned Underground Exploration/Mining Sites in the Taiga Shield Ecozone

Mine Company	Mine Name *	Location	Latitude	Longitude	Site Development **	Remedial Work Conducted/ Current Site Status
Pitch-Ore Uranium Mines Limited	Orb Claims, Zone 6 A	Augier Lake Area	59-32-42 to 36-27	108-46-36 to 47-28	1 inclined shaft.	Approximately 300 tonnes of waste rock on site. Last inspected in 1977-78.
Rix-Athabasca Uranium Mines Limited	Leonard Mine and No. 10 Adit	Bertha Lake Area	59-33-12 to 33-50	108-40-12 to 41-26	4 levels. 2 main adits.	Adits near the bottom of the hill sealed in 1979/80. At least 2 openings to the surface (raise and 1 other opening). Site assessment conducted in 2000.
Rix-Athabasca Uranium Mines Limited	Smitty Mine (later referred to as the Tobe Mine)		59-33-59	108-41-20	6 levels. 1 main shaft.	Openings were sealed in 1979/80. Vent raise sealed with timber. Site assessment conducted in 2000.
Rix-Athabasca Uranium Mines Limited	Smitty Mine (No. 62 zone and 62 adit)		59-34-03	108-41-36	At least 1 adit.	Opening sealed in 1979/80. Site assessment conducted in 2000.
Rix-Athabasca Uranium Mines Limited	No. 7 Adit	South of Chance Lake	59-33	108-43	10 trenches and 1 short adit.	Inspected in 1977-78. Site assessment conducted in 2000.
Rix-Athabasca Uranium Mines Limited		Jean Lake Area	59-34-46	108-41-31	Trenching occurred in general area.	Inspected in 1977-78.
Rix-Athabasca Uranium Mines Limited		Bertha Lake Area	59-33-25	108-40-20	Trenching occurred in general area.	Inspected in 1977-78.
Rix-Athabasca Uranium Mines Limited		Bertha Lake Area	59-33-26	108-41-18	Trenching occurred in general area.	Inspected in 1977-78.
Rix-Athabasca Uranium Mines Limited		Bertha Lake Area	59-33-30 and 59-33-59	108-40-40 and 108-41-20	Trenching occurred in general area.	Inspected in 1977-78.
Rix-Athabasca Uranium Mines Limited		Bertha Lake Area	59-33-30	108-40-40	3 sites. Trenching occurred in general area.	Inspected in 1977-78.
Rix-Athabasca Uranium Mines Limited		Boom Lake Area	59-34-59	108-41-20	2 sites. Trenching occurred in general area.	Inspected in 1977-78.
Rix-Athabasca Uranium Mines Limited		Emu Lake Area	59-33-54	108-41-30	Trenching occurred in general area.	Inspected in 1977-78.

List of Abandoned Underground Exploration/Mining Sites in the Taiga Shield Ecozone

Mine Company	Mine Name *	Location	Latitude	Longitude	Site Development **	Remedial Work Conducted/ Current Site Status
St. Michael Uranium Mines Limited		Jean Lake Area	59-34-10	108-39-50	1 shaft.	Shaft sealed in 1979. Site assessment conducted in 2000.
Strike Uranium Mines Limited	Strike Claims - Zone 7	Strike Lake	59-34-30 to 35-05	108-25-40 to 27-05	Surface trenches. 1 small adit.	1 small open adit. Inspected in 1977-78.
Territorial Uranium Mines Limited		Coe Lake Area	59-37-30	108-35-14		1 large open adit. Last inspected in March, 1999.
Uranium Ridge Mines Limited	Pitchie Claims	Hason Bay Area	59-29-00 to 30-00	108-40-00 to 41-00	Extensive drilling and surface test work conducted. At least 1 adit and 1 deep surface trench developed.	Adit sealed. Ground subsidence observed in one area. Site assessment conducted in 2000.

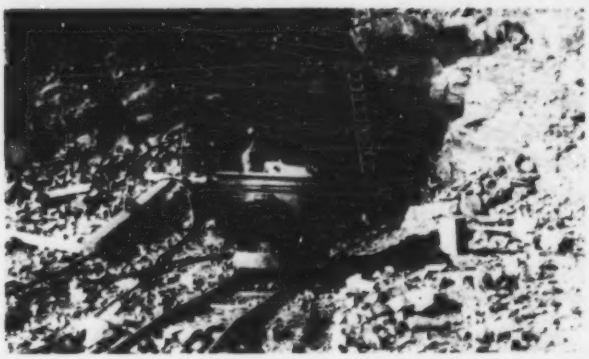
Footnotes:

**Some of the sites may contain more than one development, such as separate adits or shafts, but have been combined within this table due to their proximity and mutual ownership.*

***The data on site development was primarily obtained through literature research and may not include all public hazards, openings or other remains at the property. All of these developments are uranium exploration/mine sites unless noted.*

****These sites are not abandoned but have been included within this list because they are older developments which have not been completely decommissioned or reclaimed.*

Sources: Saskatchewan Environment and Public Safety Files (1989a), Saskatchewan Environment and Public Safety Files (1989b), Sabina, A. (1987), Mueller, G.A. (1978), Beck, L.S. (1969).



Entrance to Martin Lake mine. Miner in mucking car, October 1952.
Saskatchewan Archives Board, Photograph #R-B6183

Appendix 10

Saskatchewan's Representative Areas Network

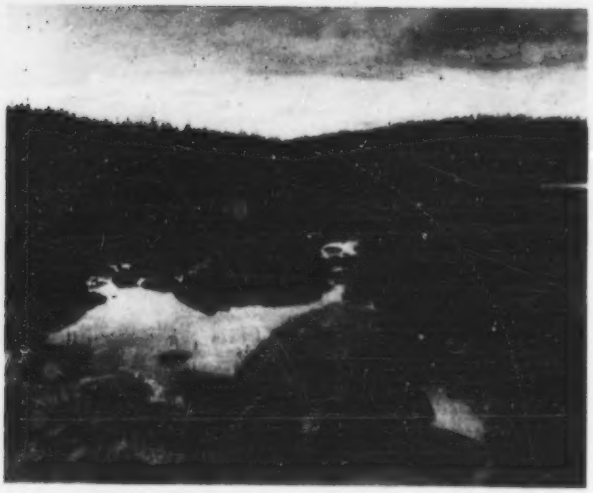
August, 1997 Final Action Plan for Saskatchewan's RAN is released to the public.

October, 1997 Partnership agreement with Ducks Unlimited Canada (DU) covering 364,230 ha of marshlands and associated uplands managed by DU.

Partnership agreement with Saskatchewan Wetlands Conservation Corporation (SWCC) covering 10,522 ha of wetlands, remnant prairies and riparian areas administered by SWCC.

November, 1997 Recognition agreement with the Redberry Lake Pelican Project and its associated upland, totaling more than 6,585 ha.

January, 1998 Official launch of the Conservation Easement Program. Three private landowners grant conservation easements in support of provincial RAN, totaling 1,012 ha.



Clear, cold stream running over a rocky bed near Hasbala Lake in the Misaw Lake Representative Area. Note large esker in background.
Robert A. Wright

February, 1998 Designation of 27 new parkland reserves in northeastern Saskatchewan totaling 76,488 ha.

Designation of two new ecological reserves and one new wildlife refuge within the Cold Lake Air Weapons Range, totaling 170,783 ha.

Partnership agreement with the federal Prairie Farm Rehabilitation Administration (PFRA) recognizing the contribution of PFRA's 728,460 ha pasture network to the network.

February, 1999 Designation of two ecological reserve representative areas in the Boreal Plain Ecozone, totaling 245,636 ha (Wapawekka Hills and Seager Wheeler Lakes).

Designation of MacDowell Bog Protected Area (57 ha).

Expansion of Douglas Provincial Park (1300 ha).

Memorandum of Understanding with Canadian Forces Detachment Dundurn, in the Prairie Ecozone, covering 22,000 ha.

Memorandum of Understanding with the Canadian Wildlife Service, to recognize 10 migratory bird sanctuaries within the RAN, totaling 54,390 ha.

Memorandum of Understanding with the Potash Corporation of Saskatchewan at Rocanville, in the Prairie Ecozone, covering 1,489 ha of land.

Continue with the acquisition of conservation easements affecting private land.

Certain Fish and Wildlife Development Fund (FWDF) land purchases that secure habitat for the province.

August, 2000 Designation of seven new ecological reserve representative areas, totaling about 120,000 ha in the Mid-boreal Lowland Ecoregion (Amisk Lake, Sturgeon-weir River), Churchill River Upland Ecoregion (Halldorson Bay, Perry Lake, Mari Lake, Jan Lake) and Mid-boreal Upland Ecoregion (Selenite Point).

October, 2000 Comprehensive progress report released.

Ongoing	Continue with the acquisition of conservation easements affecting private land.
	Certain Fish and Wildlife Development Fund (FWDF) land purchases that secure habitat for the province.
	Continue with public consultation processes leading to site designation of several key sites in three ecozones, including three sites in the Taiga Shield Ecozone.

In total these initiatives have resulted in 1.7 million hectares of land being recognized as contributing to the RAN since 1997, for a total of about 4.6 million hectares of lands protected in Saskatchewan. When designation processes are complete, it is expected that the RAN will include some 6.5 million hectares or roughly 10% of the total area of Saskatchewan.

Glossary

adit – a nearly horizontal mine opening to which a mine is entered, drained or ventilated.

adsorption – the physical binding of a particle of a particular substance to the surface of another by adhesion or penetration.

alluvial – pertaining to, or composed of, alluvium, or deposited by a stream or running water.

alluvium – clay, silt, sand or gravel deposited by a stream or running water in the bed of the stream or on its flood plain or delta.

analyte – object being measured in an analysis.

aquaculture – the managed production of fish under controlled conditions.

aquifer – stratum or zone beneath the earth's surface which contains groundwater.

base metal – any of the more common and more chemically active metals, e.g., lead, copper and zinc.

basement rocks – a complex of undifferentiated rocks that underlies the sedimentary rocks and deposits in an area. In Saskatchewan, the rocks of the complex are igneous and metamorphic and of Precambrian age.

bedrock – rock, usually solid, that underlies soil or other unconsolidated, superficial material.

biodiversity (biological diversity) – refers to the wealth of life forms on earth, including plants, animals, microorganisms, the genes they possess and their habitats.

bog – a plant community on wet, very acid peat.

brunisolic soil – soils associated with sandy glacial deposits.

climax vegetation – the complement of plants which the climate of the area favors most, namely its "natural vegetation."

coniferous – evergreen shrubs and trees characterized by needle-shaped leaves, cones and a resinous wood.

consultation – a formal or informal process to obtain public feedback, opinion or advice for decision-making.

continental climate – a climate associated with the interior regions of large continents and having wide variations in temperature.

country foods – the food people get from the land in the area where they live and range, through hunting, trapping, fishing and gathering.

cryosolic – a soil that has permafrost within 1 m or 2 m of the surface.

crystalline rock – an igneous or metamorphic rock, as opposed to a sedimentary rock.

dissolved oxygen – oxygen molecules that are dissolved in water, usually expressed in milligrams per litre (mg/L) or parts per million (ppm).

diversity – a measure of the number of species and their relative abundance.

drift – rock material transported by glaciers and deposited directly from the ice or through melting.

drumlin – streamlined hill, largely of glacial till, with the blunt end pointing into the direction from which ice moved. Occur in clusters called drumlin fields.

dune – a low mound, ridge, bank or hill of loose windblown granular material (usually sand), either bare or covered with vegetation, capable of movement from place to place, but always retaining its own characteristic shape.

ecological reserves – provincial Crown lands which are established to protect unique or representative parts of the natural environment to preserve biological diversity and provide areas in which to conduct scientific research and outdoor education.

ecoregion – broad integrated land area characterized by a unique combination of landscape, physiography and ecoclimate within the Ecological Land Classification (ELC) System.

ecosystem – a natural association of plants, animals and other organisms, together with the non-living components of their environment.

ecosystem indicators – indicators which measure and track changes in the health of the ecosystem.

ecosystem management – the integrated management of natural landscapes, ecological processes, physical and biological components and human activities to maintain ecological health and integrity of an ecosystem.

ecozone – the broadest level in a hierarchy of ecological units within the Ecological Land Classification (ELC) System, which are units of the Earth's surface with distinctive combinations of physical characteristics.

endangered – see species.

endemic – a plant or animal that is confined to a small area, or is very limited in geographic distribution.

esker – a winding ridge of stratified glacial drift, formed in a glacial tunnel and exposed when ice melted during the retreat of glaciers.

evapo-transpiration – the movement of water from the soil and plant communities to the atmosphere by evaporation of water from the soil and transpiration of water by plants.

exotic – describes a species not native to a given area, introduced from elsewhere.

extinct – see species.

extirpated – see species.

facies – the aspect, appearance and characteristics of a rock unit, usually reflecting the conditions of its origin, especially as differentiating it from adjacent or associated units.

fault – a fracture or zone of fractures along which there has been relative movement of the sides parallel to the fracture.

fen – land covered wholly or partially with slowly moving water, but producing sedge, coarse grasses, or other aquatic plants and/or slightly acidic peat.

fissures – extensive cracks, breaks or fractures in the rocks.

geological domain – an area in which a given set of physical controls combined to produce a distinctive sedimentary facies or rock unit.

glacial deposits – earth material accumulated and left behind by glaciers.

glacial drift – material laid down directly by ice or deposited in lakes, oceans or streams, as result of glacial activity.

glacial till – a heterogeneous mixture of unsorted mineral material deposited directly by glacier ice, with very little subsequent reworking by water.

glaciofluvial deposits – gravelly to sandy stratified materials, laid down in stream beds by glacial meltwater.

gleysolic soil – an order of soil developed under wet conditions.

gneiss – rocks formed by metamorphism of granite.

greenhouse gases – gases such as carbon dioxide, methane, chlorofluorocarbons, nitrous oxide and water vapor that trap heat in the Earth's atmosphere and contribute to global warming.

groundwater – that part of the subsurface water that is the zone of saturation, including underground streams.

hummocky – characterized by low, rounded hills or mounds.

hydrocarbons – any of a class of compounds consisting of only carbon and hydrogen.

invertebrates – animals without backbones.

kame – a mound, knob of short irregular ridge deposited by a subglacial stream as a fan or delta at the margin of a melting glacier.

lichen – a symbiotic organism created by the association of a fungus with an algae.

marsh – wet, or periodically wet, area, with aquatic and grass–like vegetation and no peat formation.

micron – 39.37 millionths of an inch, or 0.001 millimetre

moraine – any landform composed largely of till. If eroded, moraines are bouldery at the surface.

Northern Administration District (NAD) – that area of Saskatchewan, lying generally north of the agricultural area of the province, where there are no rural municipalities.

oligotrophic – nutrient-poor or having minimal levels of nutrients, usually in reference to waterbodies.

ore – the naturally occurring material from which a mineral or minerals of economic value can be extracted at a reasonable profit.

organic soil – a type of soil developed primarily from organic (containing carbon) deposits.

outcrops – the part of a geologic formation or structure that appears at the surface of the earth, or bedrock that is covered by surficial deposits such as alluvium.

palaeontology – study of fossils of vertebrate animals and some invertebrate animals and plants that lived in the geological past.

palsas – irregular peat domes that can rise 2.5 m or more above the surrounding organic terrain. A palsa is formed when accumulating peat and developed plant cover insulate the frozen layer and allow it to increase in volume. As the frozen layer thickens and the height of the palsa increases, it becomes unstable: cracks form in the top dome and the sides slump, breaking the insulating layer, changing the energy balance and causing the frozen lens to melt and eventually collapse completely, leaving a small pool of water. A sedge meadow forms initially, and trees invade very slowly. This results in a nearly circular, treeless patch of meadow in a treed bog, known as a "palsa scar." These palsas indicate the relatively recent disappearance of discontinuous permafrost from organic terrain.

partnerships – a cooperative, collaborative alliance between stakeholders in a non–legal arrangement used to improve and build relationships and achieve common goals.

PCB – organic compound made up of polychlorinated biphenyls, which are carcinogenic.

peat – vegetable matter partly decomposed in wet acid conditions to form a brown deposit like soil.

peneplain – a large area covered by a low, nearly featureless, gently undulating land surface.

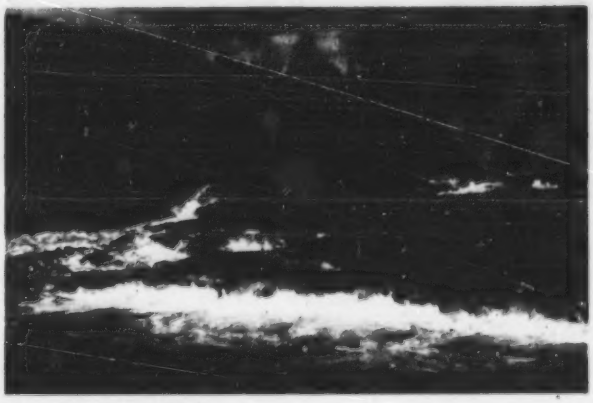
permafrost – a type of ground which is permanently frozen.

pesticide – substances such as herbicides, insecticides, fungicides, nematocides and rodenticides, used to kill unwanted pests.

platinum group metals – the group of minerals including palladium, native platinum, osmium, iridium, rhodium, ruthenium, and their alloys.

Precambrian – geologic time from the beginning of the Earth to the beginning of the Cambrian period, when life first evolved, about 570 million years ago.

precious metals – any of the relatively scarce and valuable metals, such as gold, silver, platinum and palladium.



Tazin River. George Bihun

protected areas – designated provincial Crown lands under *The Parks Act*, or similar legislation, which protect and preserve site-specific cultural (i.e., archaeological, historical, paleontological) and natural areas of provincial significance.

provincial parks – parcels of Crown land which protect heritage resources within Saskatchewan. Provincial parks are designated in four categories:

- **historic parks** – parcels of Crown land which preserve and interpret prehistoric or historic resources representative of themes and events that have contributed to the history of the province. They provide opportunities for a variety of outdoor recreational activities which are dependent upon a historic setting.
- **natural environment parks** – parcels of Crown land which protect relatively large tracts of representative or unique natural landscapes and provide public recreational opportunities.
- **recreation parks** – parcels of Crown land which provide opportunities for intensive recreational activities in a natural setting.
- **wilderness parks** – preserve very large and remote tracts of undisturbed Crown land in a natural state, which are representative of an ecoregion(s) and allow for the pursuit of low intensity and non–mechanized wilderness recreation.

radionuclides – radioactive chemicals that are usually naturally occurring and may be found in drinking water. Typical radionuclides include radioactive isotopes of uranium, thorium, radium, lead and polonium.

riparian – pertaining to anything connected with, or immediately adjacent to, the banks of a lake, river or other body of water.

saline – pertains to soil or water rich in soluble salts.

secchi disc – a disc used to measure water transparency. The disc is 20 cm across and divided into black and white quadrants. The disc is lowered into the water and the depth is recorded at the point where the difference between the black and white areas ceases to be visible.

species – a group of individuals that share certain physical characteristics and are capable of producing fertile offspring.

- **endangered** – species on the verge of immediate extinction or extirpation.
- **extinct** – species that no longer exist anywhere.
- **extirpated** – species no longer found in the wild in Canada, although they may exist elsewhere.
- **threatened** – species likely to become endangered if the pressures from human or natural causes threatening them are not reversed.
- **vulnerable** – species at risk because of low numbers or restricted range; although not in immediate danger, they could be at any time.

stakeholders – the people or groups with a direct or indirect interest, or "stake," in an issue.

stope – angled passage from the surface into the mine.

strandline – the level at which a body of standing water meets the shoreline, especially a former shoreline now elevated above the present water level.

surficial – pertaining to or lying on the surface of the earth.

surficial aquifer – an aquifer in a sand or gravel formation at or near the surface, with very little covering material.

tailings – waste material resulting from the washing, concentration or treatment of ground ore.

thermokarst – an irregular land surface containing cave-in lakes, bogs, caverns, pits and other small depressions, formed in a permafrost region by the melting of ground ice.

till – see glacial till.

topography – the general configuration of a land surface, including its relief and the position of its natural and human-made features.

trace element – an element that is not essential in a mineral but occurs in minute but detectable quantities in the structure or is adsorbed on the surface of the mineral. It constitutes much less than 1% of the mineral. All elements, except the most common rock-forming ones (O, Si, Al, Fe, Ca, Na, K, Mg, and Ti), generally occur as trace elements, except where they are locally concentrated in their ores.

understory – that portion of the trees or other vegetation in a forest stand below the main canopy (uppermost layers of foliage in the forest) level.

watershed – an elevated boundary separating tributaries that drain into different river systems.

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